As easy as ABC?

Exploring and understanding the challenges faced by newly qualified doctors in acute care contexts

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Dedication

This thesis is dedicated to my husband Mike, who, as always, has provided unwavering support and encouragement.

Acknowledgements

I acknowledge the significant contribution that Dr Samantha Smith has made to this thesis. She has spent countless hours discussing methods, double-coding results and proof reading manuscripts. Perhaps even more importantly, she has provided the perfect blend of intellectual challenge, enthusiasm and praise. She has undoubtedly raised the quality of this work.

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Abstract

Background

Several studies have shown that newly qualified doctors often feel unprepared to provide acute care, and that such feelings are a source of anxiety and stress. The main aim of this thesis was to explore how newly qualified doctors perceive and negotiate the complex challenge of assessing and treating acutely unwell patients in the early days of their professional practice. The thesis begins by examining preparedness in a local context and proceeds to explore preparedness in acute care throughout the UK. A variety of qualitative research methods are then employed to explore behavioural influences and patterns of error within acute care contexts.

Methods

In the first instance, a questionnaire study was undertaken at the University of Edinburgh, involving feedback on preparedness for practice over three consecutive years from 2007 to 2009, against 13 major programme outcomes, from graduates and their educational supervisors. In order to gain a more global perspective, a systematic literature review synthesising work examining the perceived preparedness of UK graduates in acute care versus other General Medical Council mandated outcomes was then undertaken using five databases archiving medical, educational, nursing and psychological literature. Preparedness ratings in relation to each outcome were mapped to a novel generic rating scale to allow comparisons between studies. Six focus groups involving 36 clinicians were conducted and analysed using a constructivist grounded theory approach. The developing theory and relationships between emergent themes were refined and validated by further interviews with participants. Subsequently, 38 newly qualified doctors participated in high-fidelity simulated acute care scenarios. Each scenario was immediately followed by a debriefing which encouraged articulation of cognitive processing. Errors were identified and coded where possible using Reason's generic error modelling system (GEMS). Remaining errors were coded inductively using a modified framework analysis to discern further patterns within the data.

Results

University of Edinburgh graduates consistently felt well prepared in consultation and communication skills but less prepared in acute care and prescribing. Educational supervisors felt that graduates were least well prepared in acute care and practical procedures. The literature search recovered 256 articles, of which 10 satisfied the inclusion criteria. These articles suggested that graduates perceive themselves to be the least well prepared in acute care and prescribing, and senior doctors and other healthcare colleagues perceive newly qualified doctors to be less well prepared in acute care than any of the other outcomes. Three broad themes emerged from the focus group data: cognitive challenges, roles and responsibilities and environmental factors. Exploration of the relationships between the themes led to the development of a conceptual framework. Using evidence from the simulated scenarios, corresponding debriefs and field notes, 164 of the 243 simulated scenario errors could be classified according to the original version of GEMS. A further 26 errors were coded using two novel categories: compound error and submission error. Multidimensional analysis involving both the amplified GEMS classifications and iteratively-developed key subject areas revealed specific patterns of error such as the propensity for rule-based mistakes relating to hospital systems.

Discussion and Conclusions

This thesis adds to existing work which emphasises the complex inter-relationships between emotion, affect, decision-making and behaviour. It is the responsibility of the medical education community to ensure that newly qualified doctors are aware of the roles that these factors play in errors and adverse events. Emotional skills training, particularly with reference to dynamic, high-stakes situations, should form an integral part of basic medical training. Medical training and assessment structures currently emphasise and reward personal knowledge and academic attainment above collaboration and emotional maturity. In the drive to improve patient safety, a key component is to nurture doctors who understand human fallibility and who feel empowered to seek help, safe in the knowledge that they will not be deemed to have failed.

Declaration

This thesis is submitted to the University of Edinburgh for the degree of Doctor of Medicine. The work herein was composed by Dr Victoria Tallentire and carried out under the supervision of Dr Helen Cameron, Director of the Centre for Medical Education, University of Edinburgh and Dr Janet Skinner, Consultant in Emergency Medicine, NHS Lothian and Director of Clinical Skills at the Centre for Medical Education, University of Edinburgh.

The work was undertaken with the assistance of Dr Samantha Smith, Fellow in Medical Education at the University of Edinburgh. Her contributions are clearly indicated using her initials (SES) and, except where stated, this thesis is the result of my own work and in accordance with the University of Edinburgh regulations governing the degree of Doctor of Medicine. This thesis has not been submitted in whole or in part for any other degree, diploma or professional qualification at this or any other university.

Signed: Date: 25/2/13

Ethics

Ethical approval for all the work contained within this thesis was waived by the South East Scotland Research Ethics Service. Written consent for all audio and video data collection and publication of anonymised results was obtained from all participants. Whilst funding for this work was received from external agencies, no organisation had any involvement in research design, data collection or analysis, writing of this thesis or associated manuscripts or decisions to submit for publication.

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Research output

During the period of research the following papers were published:

1. Tallentire VR, Smith SE, Skinner J, Cameron HS. Exploring error in team-based acute care scenarios: an observational study from the United Kingdom. *Academic Medicine* 2012; 87(6):792-798.
2. Tallentire VR, Smith SE, Skinner J, Cameron HS. The preparedness of UK graduates in acute care: a systematic literature review. *Postgraduate Medical Journal* 2012; 88: 365-371.
3. Tallentire VR, Smith SE, Skinner J, Cameron HS. Understanding the behaviour of newly qualified doctors in acute care contexts. *Medical Education* 2011; 45(10): 995-1005.
4. Tallentire VR, Smith SE, Wylde K, Cameron HS. Are medical graduates ready to face the challenges of Foundation training? *Postgraduate Medical Journal* 2011; 87: 590-595.

These papers are reproduced in Appendix 7 with permissions from Lippincott Williams & Wilkins, the BMJ Group and Wiley-Blackwell.

During the period of research the following paper was accepted for publication:

1. Tallentire VR, Smith SE, Cameron HS. Designing a purposeful student assistantship. *The Clinical Teacher* [in press]. Accepted 4th January 2012.

During the period of research the following abstracts were published:

1. Tallentire VR, Smith SE, Skinner J, Cameron HS. "I just didn't think": Exploring the errors made by FY1s in acute care contexts. *Scottish Medical Journal* 2012; 57(1): 60.
2. Tallentire VR, Smith SE, Mellanby E. Exploring the errors made by newly qualified doctors in acute care contexts using high fidelity simulation. *Anaesthesia* 2011; 66 (Suppl. 1): 31 and *Anaesthesia* 2012; 67(2): 208.
3. Tallentire VR, Smith SE, Skinner J, Cameron HS. "No-one's coming and she's getting sick": The errors made by FY1s in acute care contexts. *Acute Medicine* 2011; 10(3): 138.

During the period of research the following opinion pieces, based on the content of this thesis, were published:

1. Tallentire VR, Smith SE. Medical error: time to get real? *Medical Education* 2012; 46(7): 632-634.
2. Tallentire VR. Preparing for practice: what really counts? *The Clinical Teacher* 2011; 8: 280-281.

During the period of research the following oral presentations were given at conferences:

1. Using video-reflexivity to explore the errors made by FY1s in simulated acute care contexts. Association for the Study of Medical Education Annual Researching Medical Education conference (doctoral work-in-progress session); 16th November 2011; London, UK
2. "I just didn't think": Exploring the errors made by FY1s in acute care contexts. Scottish Society of Physicians 53rd annual conference; 1st October 2011; Dumfries, UK
3. Exploring the errors made by FY1s in acute care contexts. Scottish Clinical Skills Network 11th annual conference; 15th September 2011; St Andrews, UK
4. An exploration of the errors made by newly qualified doctors in acute care contexts. Association for the Study of Medical Education Annual Scientific Meeting; 15th July 2011; Edinburgh, UK
5. Understanding newly qualified doctors' behaviour in acute care contexts: development of a conceptual framework. Fourth International Clinical Skills conference; 24th May 2011; Prato, Italy
6. "No-one's coming and she's getting sick": Exploring the errors made by FY1s in acute care contexts. The Society for Acute Medicine Spring Meeting; 6th May 2011; Bristol, UK
7. As easy as ABC? : Understanding the behaviour of newly qualified doctors in acute care contexts. Clinical Skills Managed Educational Network Research and Development conference; 18th March 2011; Stirling, UK

8. Evaluating preparedness for practice from different perspective: lessons from the last three years. Association for Medical Education in Europe conference; 7th September 2010; Glasgow, UK
9. As easy as ABC? Exploring the factors affecting newly qualified doctors' delivery of acute care. Association for the Study of Medical Education Annual Scientific Meeting; 22nd July 2010, Cambridge, UK

During the period of research the following poster presentations were given at conferences:

1. Understanding newly qualified doctors' acute care behaviour. South East Faculty of Clinical Educators symposium; 22nd February 2012; Edinburgh, UK
2. Exploring the errors made by newly qualified doctors in acute care contexts using high fidelity simulation. Association for Simulated Practice in Healthcare conference; 9th November 2011; Cardiff, UK
3. Exploring the errors made by newly qualified doctors in acute care contexts using high fidelity simulation. Association of Anaesthetists of Great Britain and Ireland annual congress; 22nd September 2011; Edinburgh, UK
4. "The reality is that you panic": Understanding newly qualified doctors' acute care behaviour. Association for Medical Education in Europe conference; 30th August 2011; Vienna, Austria

During the period of research the following prizes were obtained:

1. The Association for the Study of Medical Education New Researcher of the Year Award 2012
2. The Fitzgerald Peel prize for the best oral presentation at the Scottish Society of Physicians annual conference 2011
3. Best oral presentation prize at the Scottish Clinical Skills Network annual conference 2011
4. Best poster prize at the Association for Simulated Practice in Healthcare conference 2011
5. Second prize in the poster competition at the Association of Anaesthetists of Great Britain and Ireland annual congress 2011

Chapter 1: Introduction

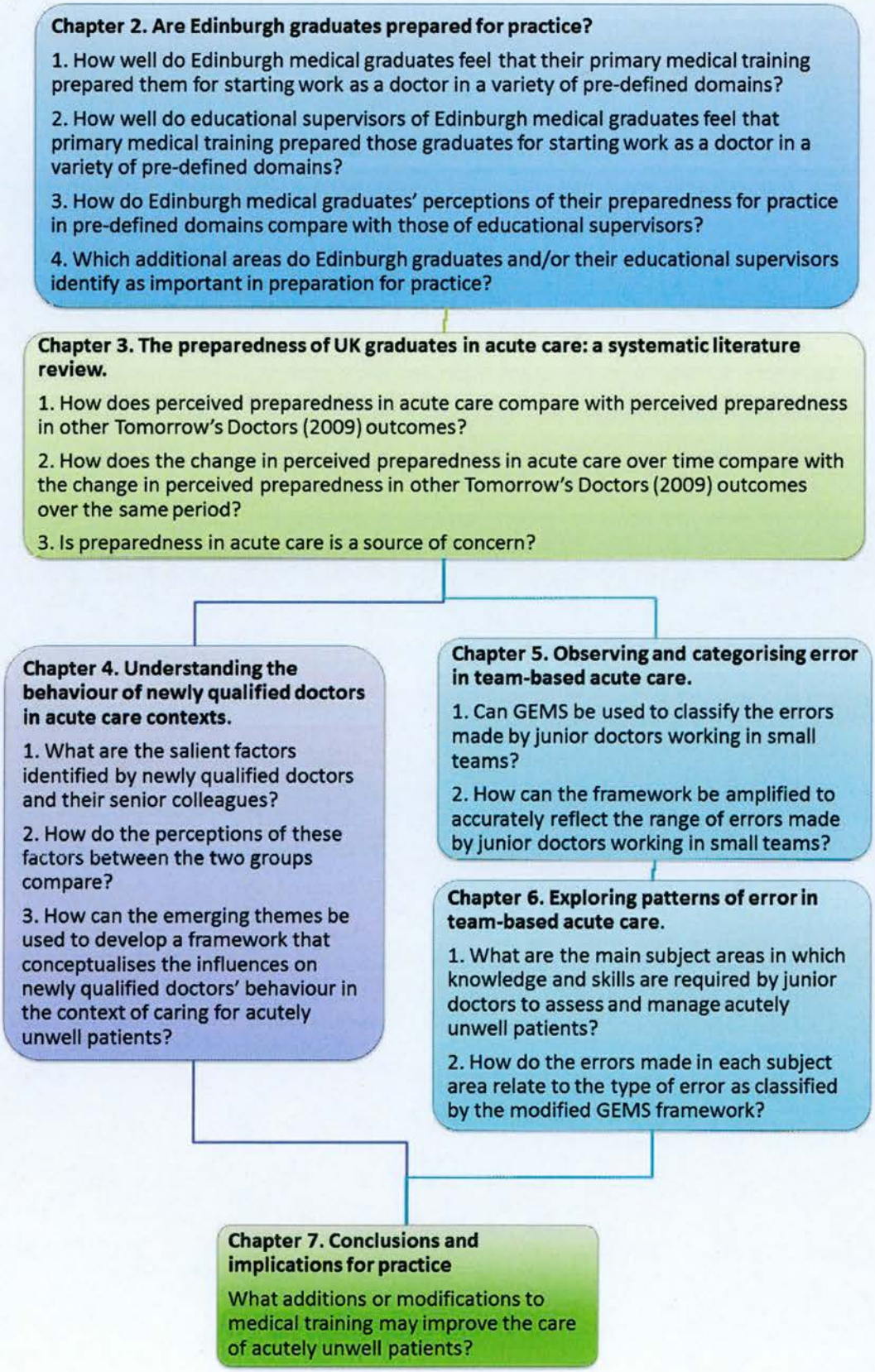
1.1 Preparedness for practice

The fundamental aim of any primary medical training programme is to adequately prepare students for clinical practice. In the UK, most medical graduates proceed directly to the two-year Foundation programme, which consists of six four-month hospital and community based rotations. Foundation year 1 doctors (FY1s) are usually closely supervised during the day but also work out-of-hours shifts during which supervision is provided only when requested.

The General Medical Council (GMC) is the statutory body with ultimate responsibility for determining and quality-assuring UK medical school curricula. Since 1993, the GMC has produced several versions of *Tomorrow's Doctors*, a document which provides guidance to medical schools on how best to ensure that their graduates are "*properly prepared for clinical practice and the Foundation Programme*" (G.M.C., 2009). Given its regulatory capacity, such guidance actually defines requirements relating to educational outcomes and processes. Consequently, between 1998 and 2006, all UK medical schools initiated major curricular revisions to align their courses with the recommendations featured in *Tomorrow's Doctors* (G.M.C., 1993). It was hoped that these changes would improve graduates' preparedness for practice by better aligning the material learnt at medical school with the skills and knowledge required in the workplace.

However, recent UK studies demonstrate shortfalls in the perceived preparedness of graduates, with only 59% of 2004 graduates (Cave et al., 2007) and 58% of 2005 graduates (Goldacre et al., 2010) agreeing that their medical school had prepared them for the jobs undertaken when qualified. This perception is supported by data suggesting that patients admitted on the day that junior doctors commence work in the UK have an in-hospital death rate six percent higher than those admitted a week previously (Jen et al., 2009). This thesis begins by exploring the perceived preparedness of Edinburgh MBChB graduates in chapter 2. The findings detailed in chapter 2 subsequently guided the research questions addressed throughout the remainder of this thesis, as shown in Figure 1.

Figure 1 - Flow diagram detailing the titles and research questions of each chapter



1.2 Acute care

In chapter 3, the 2009 version of *Tomorrow's Doctors* is used as the framework for a systematic literature review examining perceived preparedness in acute care from a variety of perspectives. The findings detailed therein pave the way for the remaining chapters which use a variety of conceptual frameworks, data collection methods and analysis techniques to illuminate the specific challenges faced by newly qualified doctors as they endeavour to assess and treat acutely unwell patients.

The majority of acutely unwell patients encountered by newly qualified doctors are hospital in-patients. However, similar patients may present in other settings, such as general practice or as new admissions to an assessment area. The ability to respond appropriately to a deteriorating patient is therefore a key component of a newly qualified doctor's role, regardless of their specific placements during the Foundation Programme and beyond. Recognising this requirement, the 2009 version of *Tomorrow's Doctors* states that graduates must be able to "*provide immediate care in medical emergencies*" (G.M.C., 2009).

The UK healthcare system is structured such that deteriorating in-patients are often assessed and treated, at least initially, by teams of ward-based junior doctors within their first year of practice. Owing to the competing demands on their time, senior doctors are often not immediately available. Consequently, there are occasions when newly qualified doctors are expected to contact the appropriate specialist(s) based on their assessment of the patient's condition and the urgency of the situation at hand.

Throughout this thesis, 'acute care' refers to all assessment, investigative and treatment processes involved in managing patients who are severely unwell and at high and imminent risk of death. It applies to all such patients, regardless of context, as it is the process as opposed to the setting that is the focus of study. It includes unconscious patients, but excludes 'cardiac arrest' situations, in which the heart has ceased to beat and any chance of recovery can only be preserved by cardiopulmonary resuscitation. A patient in cardiac arrest requires urgent and effective management, but the diagnostic challenge is minimal and management algorithms are so universal and specific that treatment decisions tend to be less ambiguous than in patients who

are deteriorating but retain a cardiac output. Furthermore, well recognised procedures such as the 'cardiac arrest call' mean that such patients are usually managed by multi-professional 'cardiac arrest teams' led by experienced doctors and nurses. For these reasons, patients in cardiac arrest are of less concern from an educational perspective.

1.3 Rationale and approach

The survival of acutely unwell patients depends upon treatment that is prompt, appropriate and error-free (McQuillan et al., 1998, McGloin et al., 1997). Despite the differing research questions contained within each chapter, the overarching aim addressed in chapters 4 to 7 of this thesis is to explore how newly qualified doctors perceive and negotiate the complex challenge of assessing and treating acutely unwell patients in the early days of their professional practice.

In order to address this aim, chapters 4 to 6 explore the challenge of acute care from two complementary perspectives. Chapter 4 attempts to unravel some of the complex factors influencing the behaviour of newly qualified doctors in acute care contexts. Chapters 5 and 6 explore acute care from the perspective of error. Chapter 5 tests the application of an existing error-modelling framework to acute care contexts, and amplifies it to include errors specific to team-based contexts. Chapter 6 uses the amplified version of the framework developed in chapter 5 to explore patterns of error and identify the knowledge and skills that are most vulnerable to specific error types.

Chapter 7 assimilates the findings detailed throughout the thesis to discuss implications for practice. It includes suggestions relating to both undergraduate and postgraduate training which, on the basis of this work, are likely to improve the care of acutely unwell patients.

1.4 Theoretical framework

The work contained in this thesis was conducted from various theoretical perspectives. The approach within each chapter was guided by the specific research questions being addressed, so that the aims, methods and presentation of results

within each chapter are constructively aligned. Chapters 2 and 3 are conducted from a largely post-positivist perspective. Positivism is founded in the work of Auguste Comte (1798-1857) who first described the use of reason and experiment as a way of understanding behaviour (Cohen et al., 2007). The underlying theoretical perspective of positivism is objectivism, the concept that there are 'facts' about the social world that are 'true' and can be 'discovered' (Illing, 2007). Post-positivism shares with positivism the belief that there is an objective reality that can be elicited provided that appropriate research methods are utilised (Lingard and Kennedy, 2007). However, the post-positivism perspective is less dogmatic than positivism and acknowledges that access to reality is limited by human inadequacy and subject complexity (Illing, 2007). Post-positivism builds on the premise that complex human behaviour is influenced by individual preference and motivation as well as prevailing cultural norms and religious environments. Reality is assumed to exist, but unlike the positivist researcher, the post-positivist acknowledges that "*reality cannot be truly 'known'*" (Illing, 2007).

In contrast, the research questions in chapters 4 to 6 have been approached from a constructivist perspective. Constructivism is the view that meaning is not discovered or created, but is socially constructed (Illing, 2007). It is one of several epistemologies grounded in the theoretical perspective of interpretivism. The central aim of research undertaken within the interpretive paradigm is to understand the complex domain of human experience (Cohen et al., 2007). Acceptance of a socially constructed reality (as opposed to an objective reality) compels any researcher exploring human experience to focus on participant perspectives. Chapters 4 to 6 of this thesis explore such perspectives in an attempt to address the complex question of how socially-constructed realities influence behaviour, error and ultimately patient outcomes.

1.5 Influential theories

This thesis contains exploratory work which draws, directly or indirectly, on various specific theories or 'conceptual frameworks' (Rees and Monrouxe, 2010). These include the works of Piaget, Lave and Wenger, and Reason. By way of introduction,

the main influences are summarised here, but more detail on each framework is provided in the relevant chapter.

Piaget was concerned primarily with the cognitive aspect of learning and described learning as a process by which individuals 'assimilate' impressions from the environment which are adopted as extensions to existing cognitive schemes or knowledge structures (Piaget and Inhelder, 1969). In other words, new knowledge is 'bolted on' to existing knowledge as each individual constructs his or her own unique and complex understanding of the world, a process Piaget called 'assimilation'. On occasion, however, new knowledge does not fit existing structures, and learning therefore requires that such cognitive models are either relinquished or reconfigured, an uncomfortable and demanding process which Piaget called 'accommodation' (Piaget and Inhelder, 1969). Piaget's work provided much of the context for the parts of this thesis that explore the contribution of an individual's cognition to behaviour and error.

Lave and Wenger's popular situated learning theory (Lave and Wenger, 1991) has also influenced the work contained in this thesis, particularly in relation to professional identity formation. The concept of 'legitimate peripheral participation' developed by Lave and Wenger is built around the premise that a learner becomes less 'peripheral' as they not only gain additional knowledge and experience, but also develop a new identity as a member of a particular 'community of practice' (Lave and Wenger, 1991). The influence of Lave and Wenger is most evident in chapter 4 where the importance of identity issues in the origins of newly qualified doctors' desires to demonstrate clinical independence is discussed.

Finally, the conceptual framework forming the basis of chapters 5 and 6 is the generic error-modelling system (GEMS) devised by James Reason (Reason, 1990). GEMS is a system of human error classification that recognises the importance of both cognitive processing and observed behaviour. It is therefore particularly well suited to categorising errors which have been observed, with or without an accompanying explanation.

These frameworks and others have guided the work detailed in this thesis. They are used as springboards for the development of ideas and the formulation of novel research techniques. It is hoped that through illuminating the practical challenge of acute care using a variety of sociological, educational and psychological theories, the construction of new knowledge will lead to fresh insights and the generation of novel educational strategies.

Chapter 2: Are Edinburgh graduates prepared for practice?

2.1 Introduction

Guided by the recommendations featured in the 1993 version of *Tomorrow's Doctors,* the curricular revisions undertaken by all medical schools between 1998 and 2006 aimed to improve graduate preparedness for the Foundation Programme. However, along with the shortfalls in the perceived preparedness of graduates described in chapter 1 (Cave et al., 2007, Goldacre et al., 2010), UK studies have demonstrated variable degrees of consistency between the preparedness ratings that newly qualified doctors give themselves and those awarded by their educational supervisors. In a West Midlands study, graduates consistently rated themselves significantly higher than did their educational supervisors in the vast majority of domains (Wall et al., 2006). However, studies in Manchester (Jones et al., 2001) and Liverpool (Watmough et al., 2006a, Watmough et al., 2006b) demonstrated a better degree of concordance between the perceptions of newly qualified doctors and their supervisors. A Bristol study that asked new doctors near the end of their first postgraduate year to rate their own levels of competence in a variety of domains found no correlation whatsoever with matched ratings in the same domains provided by their supervising consultants (Probert et al., 2003). There are, however, multiple methodological factors that may have contributed to this discrepancy; for example, the five domains in which the new doctors and their consultants were asked to provide competence ratings were extremely broad and the total number of respondents was small (20 new doctors and 60 consultants). As Probert *et al.* acknowledged, all studies which attempt to correlate the perceptions of new graduates with those of their supervisors are limited by gender and personality effects, with women being more likely to underrate their own performance (Probert et al., 2003).

By way of context, the MBChB course at the University of Edinburgh is a five year integrated, outcomes-based programme with a spiral curriculum consisting of distinct modules and vertical themes. The 13 overarching programme outcomes define the

attributes of a successful graduate and are used to plan learning opportunities and assessment strategies. The course structure was implemented in 1998. Between 2007 and 2009 (the period examined in this chapter) there were no major curricular changes.

2.2 Chapter aims

The aim of this chapter is to explore the preparedness for practice of Edinburgh MBChB graduates, from the perspectives of both the newly qualified doctors themselves and their educational supervisors. This information will guide the remainder of this thesis. In order to achieve the overarching aim, a series of questions relating to preparedness for practice will be addressed sequentially:

1. How well do Edinburgh medical graduates feel that their primary medical training prepared them for starting work as a doctor in a variety of pre-defined domains?

2. How well do educational supervisors of Edinburgh medical graduates feel that primary medical training prepared those graduates for starting work as a doctor in a variety of pre-defined domains?

3. How do Edinburgh medical graduates' perceptions of their preparedness for practice in pre-defined domains compare with those of educational supervisors?

4. Which additional areas do Edinburgh graduates and/or their educational supervisors identify as important in preparation for practice?

2.3 Methods

2.3.1 Questionnaire design

A questionnaire study was designed and piloted in 2007. FY1s and educational supervisors were asked to rate the preparedness of FY1s in a variety of domains that mapped onto the main Edinburgh MBChB programme outcomes, as shown in Figure 2. In order to keep the survey relatively short, the questions were intentionally broad and subsequent free text areas allowed elaboration and clarification. A copy of the full survey sent to educational supervisors is shown in Appendix 1.

Figure 2 - The 13 questions relating directly to the programme outcomes of the Edinburgh MBChB, shown with the Foundation doctor stem

Please rate your preparedness for practice as a Foundation doctor at the point of graduation from medical school in the following domains:

- Ability to carry out a consultation with a patient (history, examination)
- Ability to provide immediate care of medical emergencies, including first aid and resuscitation
- Ability to assess clinical presentations, order investigations, make differential diagnoses, and negotiate a management plan
- Ability to carry out practical procedures (e.g. venepuncture)
- Ability to communicate effectively in a medical context
- Ability to prescribe drugs
- Ability to apply ethical and legal principles in medical practice
- Ability to assess psychological aspects of a patient's illness
- Ability to apply the principles, skills and knowledge of evidence-based medicine
- Ability to use information and information technology effectively in a medical context
- Ability to apply scientific principles, method and knowledge to medical practice and research
- Ability to work effectively in a health care system and engage with population health issues such as social aspects of a patients illness and health promotion
- Ability to adopt a self-directed and reflective approach to own clinical practice, ongoing learning and professional development.

Questions linked to the pre-defined domains shown in Figure 2 were used to address aims 1 to 3. Questionnaire responses were scored using a four item Likert scale (poor, satisfactory, good and very good). In order to address aim 4, two areas for free text answers were provided following the statements:

1. Please provide comments to clarify any of your answers to the above questions.

2. Are there any other specific points you wish to bring to the attention of the medical school in relation to undergraduate medical education in Edinburgh?

2.3.2 Questionnaire distribution

Approximately half of all Edinburgh graduates remain in South East Scotland to undertake Foundation training. The questionnaire was sent electronically in February 2008 via the postgraduate institute to all FY1s who had graduated from the

University of Edinburgh in 2007 and were working within South East Scotland (53% of the total graduate cohort). Graduates of other medical schools working in South East Scotland were not surveyed. Responses were completed online and returned electronically using a web-based questionnaire tool. Final datasets were downloaded anonymously and no attempts to identify individuals were made. On receipt of the questionnaire, graduates would have undertaken almost six months of work as an FY1 and thus have gained reasonable insight into the demands and expectations of the role. The same questionnaire with a different introductory sentence was simultaneously sent to all FY1 educational supervisors in South East Scotland who supervised 2007 Edinburgh graduates. General reminders were sent electronically approximately four weeks and eight weeks after distribution of the questionnaire. For the subsequent two years, the questionnaire was repeated in identical format to obtain information relating to 2008 and 2009 graduates. Around half (49%) of the 125 educational supervisors who were surveyed over the three year period supervised Edinburgh graduates for only one of the three years.

2.3.3 Data analysis

Questionnaire responses were scored as follows: poor = 1, satisfactory = 2, good = 3 and very good = 4. In order to address aims 1 and 2, simple descriptive statistics (mean, standard deviation and 95% confidence intervals) were calculated separately for all FY1 and educational supervisor scores in each domain over each of the three years. Using combined data from all three years, differences between FY1 and educational supervisor mean scores in each of the 13 domains were analysed using the unpaired *t*-test to address aim 3. A p value of less than 0.004 was considered statistically significant for the purposes of this chapter (5% significance level with Bonferroni correction for 13 comparisons). Statistical analysis was performed using Microsoft Excel 2003.

In order to elicit additional areas considered important in preparing for practice (aim 4), free text responses were analysed thematically. Open coding was undertaken using NVivo8 software which allows development of a cross-group thematic framework whilst retaining the ability to check contextual validity and source (e.g.

year) of individual comments. VRT and SES independently assigned codes to emerging areas of interest, continually renaming, redefining and reorganising the codes to build a thematic grid (Kennedy and Lingard, 2006). Following initial coding, VRT and SES discussed differences in the emergent themes until agreement was reached. The data were then recoded by both researchers and the cross-check was repeated, with persisting differences again discussed to agreement.

2.4 Results

Total response numbers and rates for each cohort are summarised in Figure 3. There are a smaller number of educational supervisors than FY1s in each year cohort as some consultants provide educational supervision to several Foundation doctors. Overall response totals across the three years were 107 FY1s and 85 educational supervisors.

Figure 3 - Response numbers and rates

	2007 graduates		2008 graduates		2009 graduates	
	FY1s	Educational supervisors	FY1s	Educational supervisors	FY1s	Educational supervisors
Total number of respondents	52	45	36	16	19	24
% response rate	44%	56%	35%	24%	22%	35%

2.4.1 Perceived preparedness in pre-defined domains

For the FY1 and educational supervisor datasets, the mean score (and standard deviation) for each domain within each year group is shown in Figure 4. In addition, the figure shows the combined means for each domain using the data from all three years. For ease of analysis, poorer mean scores are represented by darker shades. The shading highlights the consistency in the scores that were obtained within each group across the three years.

Figure 4 - Mean (and standard deviation) in each domain for each year group

	FY1 responses				Educational Supervisor responses			
	2007	2008	2009	Overall	2007	2008	2009	Overall
Consultation	3.35 *(0.68)*	3.42 *(0.55)*	3.11 *(0.65)*	**3.33** *(0.64)*	2.69 *(0.79)*	2.69 *(0.79)*	2.57 *(0.89)*	**2.65** *(0.81)*
Communication	3.13 *(0.77)*	3.53 *(0.56)*	3.00 *(0.74)*	**3.24** *(0.72)*	2.71 *(0.66)*	2.81 *(0.75)*	2.58 *(0.65)*	**2.69** *(0.67)*
Psychological aspects	3.08 *(0.66)*	3.19 *(0.62)*	3.16 *(0.83)*	**3.13** *(0.75)*	2.43 *(0.73)*	2.50 *(0.73)*	2.41 *(0.85)*	**2.44** *(0.84)*
Social aspects	3.12 *(0.68)*	3.11 *(0.75)*	3.05 *(0.69)*	**3.10** *(0.70)*	2.42 *(0.70)*	2.44 *(0.51)*	2.61 *(0.89)*	**2.48** *(0.72)*
Self-directed	3.02 *(0.64)*	3.31 *(0.62)*	2.89 *(0.66)*	**3.09** *(0.65)*	2.32 *(0.83)*	2.31 *(0.87)*	2.58 *(0.92)*	**2.39** *(0.86)*
IT	2.92 *(0.76)*	3.19 *(0.58)*	2.68 *(0.75)*	**2.97** *(0.72)*	2.98 *(0.74)*	3.06 *(0.57)*	2.88 *(0.74)*	**2.96** *(0.70)*
Practical procedures	2.75 *(0.82)*	3.14 *(0.76)*	3.11 *(0.74)*	**2.94** *(0.80)*	2.09 *(0.78)*	2.00 *(0.68)*	2.10 *(0.88)*	**2.08** *(0.78)*
Assess clinical presentations	2.77 *(0.70)*	2.94 *(0.68)*	2.74 *(0.56)*	**2.82** *(0.67)*	2.20 *(0.78)*	2.13 *(0.96)*	2.30 *(0.82)*	**2.21** *(0.82)*
Ethical and legal	2.82 *(0.74)*	2.78 *(0.68)*	2.84 *(0.76)*	**2.81** *(0.72)*	2.48 *(0.71)*	2.86 *(0.77)*	2.65 *(0.83)*	**2.59** *(0.77)*
Scientific methods	2.65 *(0.74)*	2.94 *(0.79)*	2.42 *(0.61)*	**2.71** *(0.75)*	2.19 *(0.77)*	2.25 *(0.77)*	2.17 *(0.65)*	**2.20** *(0.73)*
EBM	2.55 *(0.73)*	2.66 *(0.64)*	2.32 *(0.75)*	**2.54** *(0.70)*	2.26 *(0.69)*	2.40 *(0.74)*	2.26 *(0.69)*	**2.28** *(0.69)*
Emergency care	2.52 *(0.70)*	2.58 *(0.87)*	2.37 *(0.76)*	**2.51** *(0.77)*	2.20 *(0.68)*	1.86 *(0.53)*	2.05 *(0.72)*	**2.09** *(0.67)*
Prescribing	2.33 *(0.79)*	2.69 *(0.86)*	2.37 *(0.76)*	**2.46** *(0.81)*	2.09 *(0.79)*	2.13 *(1.15)*	2.22 *(0.90)*	**2.13** *(0.89)*

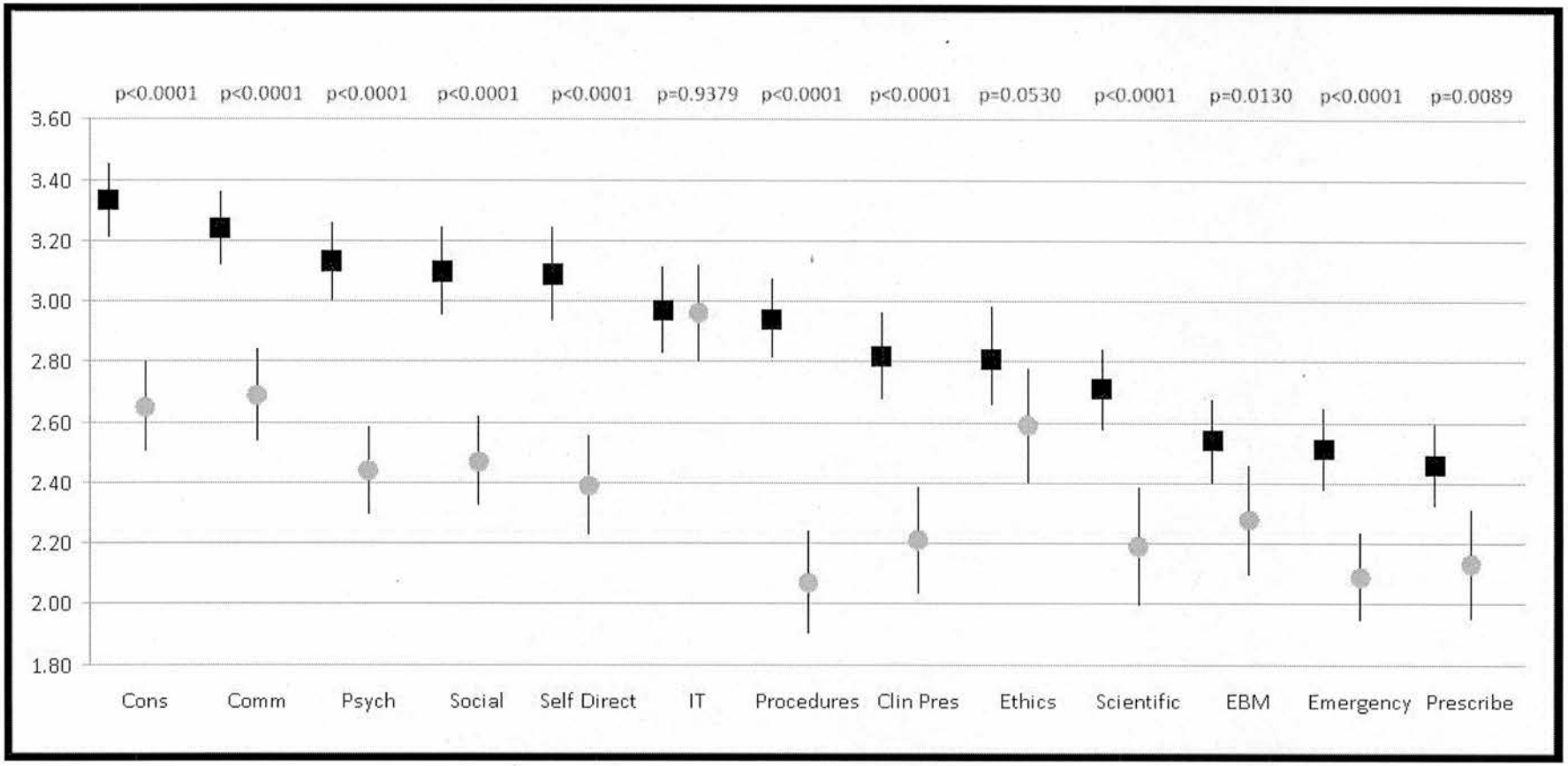
Figure 4 shows that across all three years, FY1s felt most prepared in their 'ability to carry out a consultation' and least prepared in their 'ability to prescribe drugs'. Educational supervisors considered FY1s to be most prepared in relation to their 'ability to use information and information technology' and least prepared in their 'ability to carry out practical procedures'. The Likert scale used in the questionnaire employed a rating of 2 to indicate 'satisfactory' preparation for starting work as a doctor within a particular domain. None of the mean FY1 scores fell below a value of 2 across the three years studied indicating that, on average, they felt at least satisfactorily prepared in all domains. Only one of the mean educational supervisor scores fell below a value of 2 (1.86 for 'ability to provide immediate care of medical

emergencies' in relation to 2008 graduates) indicating that this is the only domain in which educational supervisors would, in general terms, rate graduate preparation as 'unsatisfactory'.

2.4.2 Comparison of perceptions in pre-defined domains

Using the combined means from all three years shown in Figure 4, two of the top three domains as scored by the FY1s also fall within the top three domains as scored by their educational supervisors (carrying out a consultation and communication). Agreement in domains with poorer scores is less consistent, but three of the five lowest scoring domains using combined FY1 scores also fall within the lowest five domains as scored by educational supervisors (prescribing, emergency care and application of scientific method). However, Figure 4 also shows some striking disparities between the perceptions of the two groups. Using the combined means, the FY1s placed 'ability to carry out practical procedures' seventh in the table, but the educational supervisors rated them far less prepared in that domain, giving the lowest combined mean. To aid comparison of perceptions, Figure 5 (overleaf) is a graphical representation of overall means and 95% confidence intervals over three years for FY1s and educational supervisors. The p values from the unpaired t-test are displayed above each pair; the differences between 9 of the 13 pairs are statistically significant.

Figure 5 - Overall means and 95% confidence intervals over three years for FY1s (black squares) and educational supervisors (grey circles) in the various domains



2.4.3 Additional areas of importance

Over the three years, a total of 156 comments were made in response to the two free text questions. Some respondents made multiple comments. Forty seven comments were made by the 107 FY1 respondents, and 109 comments were made by the 85 educational supervisor (ES) respondents. Seventy seven of the comments related to the first free text question and 79 to the second, but given the similarity of content, all free text responses were thematically analysed together. Four major themes arose from the comments as described below.

2.4.3.1 Theme 1: Knowledge

Despite a specific question enquiring about preparedness to 'prescribe drugs', there was discontent expressed by both FY1s and educational supervisors in relation to pharmacology knowledge and practical prescribing ability.

> FY1 (2008): "I feel that my knowledge of pharmacology was poor compared to other aspects of medicine..."

> ES (2007): "I would regard most FY1s as frankly reckless in their prescribing..."

Anatomy and physiology were other areas in which respondents felt that FY1s lacked knowledge, particularly in comparison with their predecessors. Additionally, FY1s were felt to have difficulties translating knowledge into practice.

> ES (2008): "Theoretical knowledge of anatomy, pathology and clinical subjects is not as strong as it used to be and this now hinders teaching in clinical years."

> ES (2008): "Good theoretical knowledge, but inexperienced at putting this into practice."

2.4.3.2 Theme 2: Skills

2.4.3.2.1 a) Technical skills

Identification and management of acutely unwell patients appeared to be a source of concern for both educational supervisors and FY1s.

> FY1 (2009): "The one set of scenarios in which we do need to act as such is very acute emergencies - an area in which we

> received far too little training given the responsibilities in this respect which circumstances often place on us."
>
> ES (2009): "They are not always good at recognising an acutely unwell patient or identifying those that need to be prioritised."

2.4.3.2.2 b) Non-technical skills

Respondents placed great emphasis on non-technical skills including decision-making, initiative and prioritisation.

> FY1 (2008): "I felt under-prepared for making clinical decisions..."
>
> ES (2007): "Very few of the FY1 doctors will take any initiative..."
>
> FY1 (2009): "We received absolutely no training in most of the critical day-to-day-relevant aspects of being an FY1: prioritising, managing and keeping track of a large workload of tasks and jobs, many of which will be completely unfamiliar..."

Interpersonal non-technical skills received more favourable comments from both groups. Whilst the FY1s were generally felt by their supervisors to be effective and sensitive communicators with patients, inter-professional communication, including referrals and ward-round presentations of patients, received more critical comments.

> ES (2008): "Although good communicators with patients, they are generally sub-optimal in their communication with other medical staff..."

A series of comments suggested that supervisors are concerned by the level of stress experienced by newly qualified doctors and that the FY1s were not optimally equipped with strategies to cope with stress.

> ES (2008): "I have been concerned about the amount of sick leave FY1s take usually related to stress."
>
> FY1 (2007): "I'm sure it must be normal for graduates to feel out of their depth when starting work, but in retrospect many parts of the curriculum seem poorly designed to help us meet this challenge as well as we might."

2.4.3.3 Theme 3: Personal attributes

There were many comments relating to personal attributes of Edinburgh graduates. Problems relating to lack of confidence were mentioned by both educational supervisors and FY1s.

> ES (2007): "They have a great deal of knowledge but little confidence..."
>
> FY1 (2008): "I ... was lacking confidence in putting pen to paper as we went from no responsibility to high levels of responsibility overnight."

Other largely complimentary comments from educational supervisors related to enthusiasm, reliability and other aspects of professionalism.

> ES (2009): "Most FY1s are bright, keen and hard-working and a pleasure to work with."

2.4.3.4 Theme 4: Familiarity with ward environment

Both FY1s and educational supervisors felt that familiarity with the environment of the wards was an important component of transition from medical student to FY1. Comments from FY1s suggested that spending longer on the wards would result in increased familiarity with the day-to-day jobs involved in 'running a ward', incorporating both clinical and administrative duties.

> FY1 (2007): "The only aspect of preparation for practice that I felt I lacked when starting was the practical experience of running a ward."
>
> FY1 (2008): "Undergraduates should have more exposure to everyday ward work and tasks, to better prepare them for FY1."

2.5 Discussion

FY1s graduating from Edinburgh medical school between 2007 and 2009 felt that their preparation for Foundation training was good in five out of the 13 MBChB programme outcomes, and satisfactory in the remaining eight. Over the same period, FY1 educational supervisors felt that the preparation for Foundation training had been satisfactory in all 13 domains. The perceptions of graduates and their educational supervisors were significantly different in the majority of domains. However, the additional aspects of preparing for practice that were identified by the two cohorts showed remarkable similarity.

In concordance with other studies, FY1s graduating from the University of Edinburgh consistently scored themselves significantly higher than did their educational supervisors in the majority of domains (Jones et al., 2001, Wall et al., 2006). It is possible that some of this difference may be due to educational supervisor bias against the domains themselves, perhaps viewing some of them as irrelevant to everyday clinical practice. The greatest disparity in the perceptions of the two groups related to 'ability to carry out practical procedures', echoing the results of a previous study (Wall et al., 2006). A South African study that correlated newly qualified doctors' self-assessment scores in practical procedures with OSCE scores also demonstrated misplaced confidence (Burch et al., 2005). The 'ability to provide immediate care of medical emergencies' was the only domain in which preparation of any graduate cohort was deemed, on average, to be unsatisfactory. Concerns relating to the care of acutely unwell patients were also evident in the qualitative data. Such findings concord with other studies and lack of preparedness in this domain appears to be a perennial problem, both within the UK and throughout the world (Lueddeke et al., 2006, Gome et al., 2008). This aspect will be explored in more detail in chapter 3.

Analysis of the free text responses highlighted a number of areas that had not featured in the questionnaire, yet were felt by respondents to be important components of preparedness for practice. Whilst the questionnaire specifically asked respondents to score 'ability to communicate effectively in a medical context', it did

not differentiate between communication with patients and colleagues. These two types of communication present subtly different challenges for newly qualified doctors, and preparedness for each is important. The free text comments indicated that some FY1s and their educational supervisors felt that they had been well prepared to communicate with patients and relatives, but less prepared in relation to communication with colleagues. It is noteworthy that most other studies in this area do not distinguish between communication contexts (Watmough et al., 2006b, Jones et al., 2001, Lempp et al., 2005). The single study that does make this differentiation concords with the finding presented in this thesis: consultants and specialist registrars felt that FY1s were better prepared for communicating with patients and relatives than with medical colleagues (Matheson and Matheson, 2009).

Opinions regarding non-technical skills such as decision-making, initiative and prioritisation were not specifically sought within the questionnaire, but were attributed importance by both FY1s and their educational supervisors. Task prioritisation has previously been identified as an important component of the FY1 role which is usually learned 'on the job', making doctors in their early days feel unprepared (Illing et al., 2008, Lempp et al., 2004). The first postgraduate year is renowned for being a stressful and difficult year (Bligh, 2002). At least some of the stress experienced by newly qualified doctors seems to relate to exposure to specific events such as acutely unwell patients, night shifts or being on call (Illing et al., 2008). It may also relate to commencing a new placement with insufficient induction processes and uncertainty of role (Paice et al., 2002). Suggestions to improve preparedness for practice made by respondents included encouraging students to spend longer on the wards to increase familiarity with day-to-day jobs and increased shadowing time. These suggestions echo the findings of a large study commissioned by the General Medical Council (Illing et al., 2008) that informed the 2009 version of *Tomorrow's Doctors* recommendation of a Student Assistantship period (in which students take on the role of Foundation doctor) as an integrated part of primary medical training (G.M.C., 2009). It will be interesting to track preparedness for practice in future years, both in our institution and UK wide, as these new standards are implemented.

2.5.1 Limitations

The work detailed in this chapter combines the strengths of three consecutive years' data with two different perspectives. It is, however, limited by its poor response rate. The inclusion of educational supervisors only (as opposed to the wider group of clinical supervisors) was likely to have resulted in the exclusion of many senior doctors with substantial experience of supervising Edinburgh graduates. Furthermore, only Edinburgh graduates who took up FY1 posts within South East Scotland were surveyed. It is possible that those who responded to the survey either had particularly strong feelings on the preparedness of Edinburgh graduates to begin clinical practice or, in the case of FY1s, felt prepared enough to devote time and energy to an optional questionnaire. The responses may therefore not be representative of the whole cohort, and consideration needs to be given to incentives and other methods of improving response rates in future years. New national application procedures for Foundation training have resulted in a gradual decrease in the number of Edinburgh graduates remaining in South East Scotland. It is therefore essential that the medical school finds ways of maintaining contact with graduates who have moved further afield and even outwith the UK.

Additional limitations relate to the structure of the questionnaire. The four item Likert scale employed (poor, satisfactory, good and very good) has two points above 'satisfactory' and may therefore have positively skewed responses. Although commonly performed in questionnaire analysis, the process of allocating numerical values to qualitative judgements (in this case poor = 1, satisfactory = 2, good = 3 and very good = 4) is always somewhat arbitrary. The standardisation of the distances between responses for the purposes of statistical analysis may seem artificial, as the difference between satisfactory and good may be considered much greater than that between good and very good. It is also unlikely that FY1s would rate themselves as 'poor', perhaps explaining to some degree the fact that FY1s consistently scored themselves significantly higher than did their educational supervisors in the majority of domains. Despite the questionnaire clearly stating that data was being collected anonymously, FY1s may still have harboured concerns that the University was able to identify them, particularly as contact had been initiated by email and many web-

based questionnaire tools are now able to track respondents. Such suspicions may have promoted artificially positive responses.

The 13 domains in which respondents were asked to rate preparedness originated from the main Edinburgh MBChB programme outcomes. In order to keep the survey short, and thereby improve the response rate, the questions were intentionally broad. However, this resulted in respondents being asked to allocate a single preparedness rating to combinations of skills (such as assessing clinical presentations, ordering investigations, making differential diagnoses, and negotiating management plans) which could have provoked a range of ratings if listed individually. For the purposes of thematic analysis, the responses obtained in the two free text areas of the questionnaire were combined. The similarity of content suggests that the questions may have been perceived as repetitive by respondents, and should perhaps be revised in future versions of the questionnaire.

The use of a questionnaire as a data collection method limited this work in terms of discovering *why* respondents hold the views that they do, a question best answered using interview based techniques. In addition, information on perceived preparedness as opposed to actual preparedness was sought, and the two variables cannot be assumed to correlate. A recent Japanese study, for example, found no correlation between pass rate on the National Medical Licensure Examination and perceived preparedness for practice in any domain (Tokuda et al., 2010).

2.5.2 Conclusion

When considered in the context of previous research, the work detailed in this chapter has identified several areas requiring further work. The suggestion that FY1s are better prepared to communicate with patients and relatives than with colleagues has received little attention in the literature and warrants further exploration. Improving the abilities of newly qualified doctors to self-assess their competence, particularly in relation to procedural skills, is crucial to ensuring the safety of patients. Finally, this chapter raises the question of whether a lack of preparedness in acute care is a problem which extends beyond South East Scotland. This question will form the basis of chapter 3.

Chapter 3: The preparedness of UK graduates in acute care: a systematic literature review

3.1 Introduction

The work detailed in chapter 2 has highlighted that University of Edinburgh graduates are perceived to be poorly prepared for professional practice in the domain of acute care. Concerns relating to the care of acutely unwell patients were also evident in the qualitative data.

The third edition of *Tomorrow's Doctors* published in 2009 lists 16 outcomes which graduates must be able to demonstrate in order to be "*properly prepared for clinical practice and the Foundation Programme*" (G.M.C., 2009). One such outcome is the ability to "*provide immediate care in medical emergencies*" (G.M.C., 2009). As discussed in chapter 1, this outcome has relevance to all specialities, whether hospital or community-based. The potential to reduce mortality by focussing on the delivery of care to this vulnerable group of patients is increasingly being recognised by healthcare improvement agencies throughout the developed world. It is of the utmost importance to senior colleagues, prospective employers and, of course, current and future patients, that medical graduates feel able to recognise acute illness and institute generic resuscitative measures whilst awaiting senior assistance.

The problem of preparedness in acute care is explored further in this chapter, taking a broader perspective by incorporating all available data from UK institutions.

3.2 Chapter aims

The aim of this chapter is to investigate the perceived preparedness of UK medical graduates in acute care relative to the other outcomes detailed *in Tomorrow's Doctors* (2009). More specifically, this chapter aims to address the following series of questions:

1. How does perceived preparedness in acute care compare with perceived preparedness in other *Tomorrow's Doctors* (2009) outcomes?

2. How does the change in perceived preparedness in acute care over time compare with the change in perceived preparedness in other *Tomorrow's Doctors* (2009) outcomes over the same period?

3. Is preparedness in acute care a source of concern?

All three questions are examined in relation to both self-perceptions and those of other healthcare professionals.

3.3 Methods

3.3.1 Search strategy

On 11th September 2011, the search strategy shown in Figure 6 was used to recover relevant articles. MESH headings were utilised infrequently as they have not been designed for the purpose of recovering medical education articles and consequently yield large numbers of irrelevant articles.

Figure 6 - Search strategy

1	foundation doctor*.tw OR foundation train*.tw OR FY1*.tw OR foundation year 1.tw OR foundation year one.tw OR (foundation adj3 train*).tw OR (foundation adj3 doctor*).tw OR new* qualif* doctor*.tw OR PRHO*.tw OR houseman*.tw OR house man*.tw OR house officer*.tw OR (medic* adj3 graduat*).tw
2	Programme Evaluation/ OR exp Professional Competence/ OR exp Curriculum/ OR (prepar* adj3 practi*).tw
3	exp great britain/ OR ireland/
4	1 AND 2 AND 3
5	Limit 4 to yr="1993 - Current"

All prefix and suffix instructions, abbreviations and symbols were used as defined in the OVID gateway. The search was limited to articles published from 1993 onwards, when the first publication of *Tomorrow's Doctors* provided an explicit framework for evaluation of preparedness for practice. Equivalent searches were carried out in five databases: Medline, ERIC (Education Resources Information Center), EMBASE (Exerpta Medica database), CINAHL (Cumulative Index to Nursing and Allied Health Literature) and PsycINFO (American Psychological Association database). Titles and abstracts were recovered for all search results.

3.3.2 Inclusion and exclusion criteria

Articles were included if they fulfilled all of the criteria listed in Figure 7. In the case of any doubt regarding inclusion, the full article was recovered and used to assess suitability.

Figure 7 - Inclusion criteria

Inclusion criterion	Justification
1. The article contains information on perceived preparedness in acute care as defined in paragraph 16 of Tomorrow's Doctors (2009), "provide immediate care in medical emergencies" (G.M.C., 2009).	Acute care is the focus of this thesis and Tomorrow's Doctors (2009) is the template chosen to compare studies included in this review.
2. The article is related to the transition from medical student to practising clinician.	This chapter focuses on preparedness for practice as a new medical graduate, so studies relating to preparedness for other transitions, such as that from specialty training to consultancy, were excluded.
3. The article is either primary empirical research or course evaluation.	This criterion excludes case studies, editorials and opinion pieces which, whilst of interest, do not provide empirical data.
4. The work originates from a UK medical school or deanery.	Given the differences in the structure of both training and hospital systems elsewhere, only UK studies are relevant to the chapter aims.

The reference lists of all articles fulfilling the inclusion criteria were searched for other relevant articles that were missed by electronic searching. Articles were excluded for the reasons listed in Figure 8.

Figure 8 - Exclusion criteria

1. The article does not include information on perceived preparedness in acute care as defined in Tomorrow's Doctors (2009).
2. The article relates to preparedness for a transition other than that from medical student to practising clinician (e.g. from specialty training to consultancy).
3. The article is neither primary empirical research nor course evaluation.
4. The article originates from an institution outwith the UK.

3.3.3 Data extraction

Data extraction and quality scoring of all articles fulfilling the inclusion criteria was undertaken independently by VRT and SES. The dataset shown in Figure 9 was collated onto a pre-prepared data extraction form in Excel (Microsoft Office 2007). Discrepancies were resolved by discussion until agreement was reached.

Figure 9 - The data extracted for all included articles

- Location of study (medical school or deanery)
- Number and grade of participants
- Method(s) of data collection
- Year of graduation
- Time since graduation
- Tomorrow's Doctors (2009) outcomes evaluated
- Summary of perceived preparedness relative to each outcome
- Quality of study

The methodological quality of each included study was assessed using the Best Evidence in Medical Education quality indicators (BEMEQI) developed by Buckley *et al.* and summarised in Figure 10 (Buckley et al., 2009). BEMEQI was chosen from the many methodological scoring systems in existence due to its relevance to the studies included in the review. Studies were considered to be of high quality if they met seven or more of the 11 quality indicators, as originally proposed by Buckley *et al.* and employed elsewhere (Miller and Archer, 2010). Studies with a BEMEQI score of less than seven were excluded from the review.

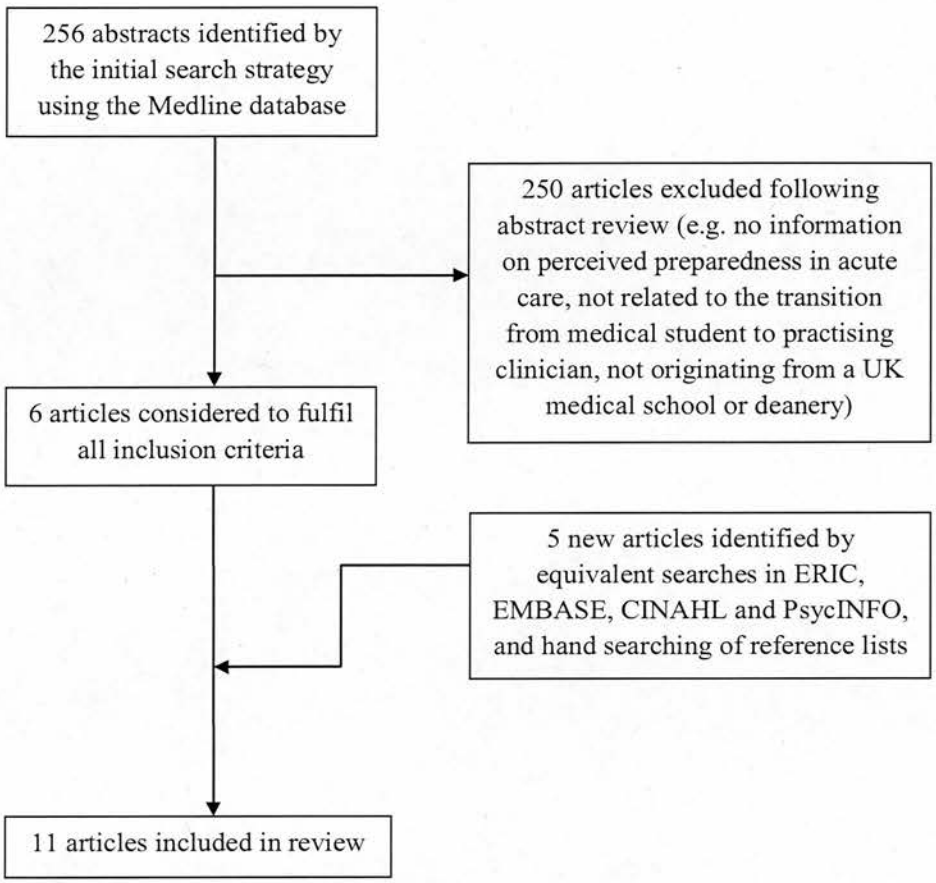
Figure 10 - A summary of the Best Evidence in Medical Education quality indicators (BEMEQI) adapted from Buckley *et al.*

Quality indicator	Detail
Research question	Is/are the research question(s) clearly stated?
Study subjects	Is the study group appropriate (size, characteristics, selection)?
Data collection methods	Are the methods reliable and valid?
Completeness of data	What is the drop out / attrition / response rate?
Control for confounding	Have confounding variables been removed / minimised / accounted for?
Analysis of results	Are the methods of analysis appropriate?
Conclusions	Can the data justify the conclusions?
Reproducibility	Could the study be repeated by another group?
Prospective	Is the study prospective (forward looking) as opposed to retrospective?
Ethical issues	Were ethical issues addressed adequately?
Triangulation	Are the results supported by data from other studies?

3.4 Results

The initial search undertaken using the Medline database yielded 256 articles. The full Medline search strategy with citation yields is shown in Appendix 2. Six articles were considered to fulfil all inclusion criteria. Equivalent searches in ERIC, EMBASE, CINAHL and PsycINFO yielded two new articles, and hand searching of reference lists yielded three more. Figure 11 summarises the search process.

Figure 11 - Flow chart of search process



The quality scores of each of the 11 papers that fulfilled all inclusion criteria are shown in Appendix 3. One of the 11 studies (Lempp et al., 2005) was given a BEMEQI score of less than seven, and was therefore excluded from the review. Five of the remaining 10 studies evaluated the preparedness of graduates of English universities (Matheson et al., 2010, Brown et al., 2010, Clack, 1994, Lempp et al., 2004, Evans and Roberts, 2006), one multi-centre study including graduates from two English and one Scottish universities (Illing et al., 2008) and another surveyed graduates of all UK medical schools (Goldacre et al., 2010). One study evaluated doctors practising in the West Midlands deanery (Wall et al., 2006) and another focused on doctors working in two hospitals in the North East Thames region (Berridge et al., 2007). The final study included in the review detailed the work

presented in chapter 2 of this thesis and therefore investigated the preparedness of graduates from a Scottish university (Tallentire et al., 2011b).

All 10 studies explored preparedness as perceived by newly qualified doctors within their first year of practice. Two studies surveyed doctors between one and three years post-graduation (Brown et al., 2010, Goldacre et al., 2010) and one study explored the perceptions of doctors with up to eight years of clinical experience (Clack, 1994). Four studies sought the views of consultants or educational supervisors on the preparedness of their junior colleagues (Brown et al., 2010, Tallentire et al., 2011b, Wall et al., 2006, Illing et al., 2008) and one study incorporated the perceptions of nursing staff and other allied health professionals (AHPs) (Illing et al., 2008).

Six of the studies contained quantitative ratings of preparedness that could be mapped to paragraph 16 of *Tomorrow's Doctors* (2009). One such study formed the basis of chapter 2 and is therefore not described here in detail (Tallentire et al., 2011b). The other five studies are described below.

3.4.1 Study summaries

In the oldest study included in the review, Clack evaluated the responses of 371 graduates of King's College School of Medicine and Dentistry to a questionnaire asking them to evaluate their undergraduate curriculum. A significant number of graduates (57.3%) felt that they had received "not enough" training in developing an "ability to deal with emergencies", with 29.6% stating that training had been "adequate" and 13.0% stating it had been "well covered" (Clack, 1994). In terms of other domains which map to *Tomorrow's Doctors* (2009) outcomes, graduates also felt that there had been "too little" course time devoted to "clinical pharmacology and therapeutics" (67.6%) and "medical ethics and law relating to medicine" (62.8%). The "ability to work in a team" was an attribute which 64.4% of respondents felt that they possessed by qualification. The paper concluded that "*most of the graduates felt ill-equipped to deal with emergencies*"(Clack, 1994) and suggested that the information gleaned would assist curriculum planners in designing

a new curriculum in light of the recommendations featured in *Tomorrow's Doctors* (1993).

Twelve years later, Wall *et al.* published a study which explored the preparedness of Pre-Registration House Officers (PRHOs) in the West Midlands Deanery, as perceived by themselves and their educational supervisors (Wall et al., 2006). The responses of 193 PRHOs on a six item Likert scale ("*1 for strongly disagree through to 6 for strongly agree*") resulted in a mean score of 4.03 for "responding effectively to emergencies". The result compared unfavourably with responses to other questions which map to *Tomorrow's Doctors* (2009) outcomes (4.99 for team working, 4.88 for communication, 4.48 for procedural skills, 4.45 for IT and 4.18 for prescribing). Of the 17 domains ranked by PRHOs, "responding effectively to emergencies" ranked 16th. In the same study, 212 consultants rated the preparedness of their newly qualified colleagues to respond to emergencies 11th of the same 17 domains, with a mean score of 3.96 on the same Likert scale. Understanding IT, team working, communication and procedural skills all obtained mean scores of between 4.35 and 4.65 (Wall et al., 2006).

Berridge *et al.* investigated the perceived preparedness of 50 newly qualified doctors commencing work in two hospitals within the North East Thames region (Berridge et al., 2007). Participants were asked to rate their confidence in, amongst other skills, assessing and initiating treatment "for an ill patient out of hours". On the first day of a two-week preparation for practice course, 50 new graduates gave their confidence in acute care a mean score of 3.26 on a 5 point Likert scale (1= strongly agree that I am confident, 3 = neutral, 5 = strongly disagree that I am confident). At the end of the two week course, 34 participants recorded that their confidence had increased to a mean score of 2.59. One month later, 35 participants recorded confidence in the same domain as 2.46 on the same Likert scale. Comparing acute care with prescribing, the only other domain of the questionnaire that maps to *Tomorrow's Doctors* (2009) outcomes, pre-course confidence was identical (3.26) but one month post-course confidence in prescribing (2.4) showed a more marked increase than confidence in acute care (2.46).

A large multi-centre study investigating preparedness for practice collected both quantitative and qualitative data on preparedness from graduates of Newcastle, Warwick and Glasgow medical schools shortly before they started work as Foundation doctors (Illing et al., 2008). Using a 5 point Likert scale (with the upper end of the scale indicating increased preparedness), 226 graduates from Newcastle University (systems-based, integrated curriculum) gave 'recognising and managing acutely ill patients' a mean score of 3.41 (SD 0.81). 131 graduates from the University of Glasgow (problem-based learning curriculum) gave the same domain a mean score of 3.44 (SD 0.78) and 123 graduates from the University of Warwick (graduate entry course) gave a mean score of 3.39 (SD 0.69). Compared to the three other questions that mapped to *Tomorrow's Doctors* (2009) domains (prescribing, ethics and team working), acute care was ranked second to team working by graduates from all three universities. A second questionnaire sent to other members of the healthcare teams (including nursing staff and senior medical colleagues) asked for a rating of 'prepared' or 'unprepared' in a variety of domains. Graduates were rated as 'unprepared' in 'acute management' by 29% of respondents in Newcastle, 13% in Warwick and 64% in Glasgow. Overall, in all three sites, new graduates were rated as 'prepared' in 'acute management' by 44% of the 63 respondents, far below the 71% who rated graduates prepared in prescribing and the 86% who rated them prepared in team working.

Finally, in the study published by Brown *et al.*, 56.4% of 200 University of Liverpool graduates working within the Mersey Deanery as FY1s rated their skills in 'recognition and management of acutely ill patients' as 4 or 5 on a 5 point Likert scale (5 = 'generally very competent', 1 ='generally not at all competent'). Compared to the other questions that mapped to *Tomorrow's Doctors* (2009) domains, FY1s felt more prepared in acute care than in prescribing, but less prepared in acute care than in communication skills or team-working. When given the same questionnaire, 80.3% of 95 FY2s gave themselves a rating of 4 or 5 in acute care, with the pattern of preparedness in other questions mapping to *Tomorrow's Doctors* (2009) domains mirroring the FY1 responses (54.6% gave a rating of 4 or 5 in prescribing, 90.9% in communication and 90.8% in team-working) (Brown et al.,

2010). When asked to rate the preparedness of the FY1s on the same scale, only 30.7% of 345 consultants in the Deanery rated FY1 doctors as 4 or 5 in acute care, 44.6% gave a rating of 3 ('quite competent') and 24.7% gave a rating of 1 or 2. Preparedness in prescribing was rated more favourably than acute care by consultants.

None of the studies described above provided data that could be mapped to all *Tomorrow's Doctors* (2009) outcomes. Figure 12 shows the number of studies providing quantitative data in relation to each of the *Tomorrow's Doctors* (2009) outcomes for graduates. Some of the outcomes were not covered by any of the studies included in the review. When an individual outcome had been subdivided within a study (such as paragraph 15, "communicate effectively with patients and colleagues in a medical context", which was divided to provide separate preparedness ratings in relation to patient and inter-professional communication in several studies (Matheson and Matheson, 2009, Clack, 1994, Illing et al., 2008)), all ratings in relation to that particular outcome were excluded from the review on the basis that the study did not provide a single preparedness rating in relation to a *Tomorrow's Doctors* (2009) outcome.

Figure 12 - Numbers of studies containing quantitative ratings of preparedness relating to each of the Tomorrow's Doctors (2009) outcomes for graduates

Tomorrow's Doctors (2009) outcomes for graduates (with corresponding paragraph number in brackets)	No of studies	References of studies
Apply biomedical scientific principles, method and knowledge to medical practice (8)	0	
Apply psychological principles, method and knowledge to medical practice (9)	0	
Apply social science principles, method and knowledge to medical practice (10)	0	
Apply population health and health improvement principles, method and knowledge to medical practice (11)	0	
Apply scientific method and approaches to medical research (12)	1	(Tallentire et al., 2011b)
Able to carry out a consultation (13)	1	(Tallentire et al., 2011b)
Diagnose and manage clinical presentations (14)	1	(Tallentire et al., 2011b)
Communicate effectively with patients and colleagues in a medical context (15)	3	(Tallentire et al., 2011b, Brown et al., 2010, Wall et al., 2006)
Provide immediate care in medical emergencies (16)	6	(Tallentire et al., 2011b, Brown et al., 2010, Illing et al., 2008, Berridge et al., 2007, Wall et al., 2006, Clack, 1994)
Prescribe drugs safely, effectively and economically (17)	6	(Tallentire et al., 2011b, Brown et al., 2010, Illing et al., 2008, Berridge et al., 2007, Wall et al., 2006, Clack, 1994)
Carry out practical procedures safely and effectively (18)	2	(Tallentire et al., 2011b, Wall et al., 2006)
Use information effectively in a medical context (19)	2	(Tallentire et al., 2011b, Wall et al., 2006)
Behave according to ethical and legal principles (20)	3	(Tallentire et al., 2011b, Illing et al., 2008, Clack, 1994)
Reflect, learn and teach others (21)	0	
Learn and work effectively within a multi-professional team (22)	4	(Brown et al., 2010, Illing et al., 2008, Wall et al., 2006, Clack, 1994)
Protect patients and improve care (23)	0	

3.4.2 Comparing perceived preparedness in acute care with other Tomorrow's Doctors (2009) outcomes

Self-perceptions of preparedness relative to *Tomorrow's Doctors* (2009) outcomes are summarised in Figure 14. Only outcomes that have quantifiable data relating to preparedness available from more than one study are included in Figure 14, as it is the trends and comparisons that form the particular focus of this chapter (seven of the 16 outcomes for graduates listed in Figure 12 are included in Figure 14). The key to the shading in Figures 14 and 15 is shown in Figure 13, and allows comparison across studies asking subtly different questions or reporting data in different ways. The ratings of self-perceived preparedness shown in Figure 14 show that overall graduates consistently consider themselves to be well prepared in communication and team-working. The two outcomes in which graduates consistently feel least well prepared are acute care and prescribing, which together account for eight of the nine ratings equating to unprepared.

Figure 15 summarises the graduate preparedness ratings given by eight groups of healthcare professionals in four separate studies. Five of the ratings are provided by consultants and the three others are given by heterogeneous groups of FY2s, more senior trainees, consultants and nursing staff. Ratings are generally lower than those given by the graduates themselves, and there are no outcomes in which graduates are consistently perceived to be well prepared. However, similar patterns emerge in relation to the outcomes in which graduates are felt to be poorly prepared, with acute care accounting for three of the five ratings equating to unprepared (obtained from three different studies).

3.4.3 Changes in perceived preparedness since the first publication of Tomorrow's Doctors

The results in Figures 14 and 15 are displayed in reverse chronological order using the year of graduation of the newly qualified doctors (not the publication years of the studies). There is some suggestion from Figure 14 that self-perceptions of preparedness in relation to practical procedures and team-working have improved since 1993. In contrast, self-perceptions of preparedness in relation to acute care,

communication and ethics have remained fairly static, with self-perceived preparedness in prescribing appearing to have declined.

Figure 15 suggests that other healthcare professionals perceive graduate preparedness in communication, ethics, prescribing and practical procedures to have remained relatively static since 1993. In contrast to the self-perceptions data, Figure 15 highlights acute care as the only outcome in which graduate preparedness is perceived to be declining, with three of the four most recent ratings equating to unprepared in the generic rating scale.

Figure 13 - Key to shading in Figures 14 and 15

Overall review rating	**Equivalent rating in studies**
Very well prepared	At least 90% of respondents feel confident / prepared (or consider their FY1 colleagues to be) or mean score equal to or above 'very well prepared' or equivalent on Likert scale
Well prepared	At least 75% but fewer than 90% of respondents feel confident / prepared (or consider their FY1 colleagues to be) or mean score equal to or above 'well prepared' but below 'very well prepared' or equivalent on Likert scale
Prepared	At least 50% but fewer than 75% of respondents feel confident / prepared (or consider their FY1 colleagues to be) or mean score equal to or above 'adequately prepared' but below 'well prepared' or equivalent on Likert scale
Not prepared	Fewer than 50% of respondents feel confident / prepared (or consider their FY1 colleagues to be) or mean score below 'adequately prepared' or equivalent on Likert scale

Figure 14 - Self-perceptions of preparedness relative to Tomorrow's Doctors (2009) outcomes

First author, respondent group, year of graduation and sample size	Description of Likert scale used	Tomorrow's Doctors (2009) outcomes for graduates (with paragraph number in brackets)						
		Communication (15)	**Acute care** (16)	**Prescribing** (17)	**Practical procedures** (18)	**Information usage** (19)	**Ethics** (20)	**Team-working** (22)
Tallentire *et al.* FY1s, 2009 (n=19)	4 point scale (1=poor, 4=very good)	Mean 3.00 (SD 0.74)	Mean 2.37 (SD 0.76)	Mean 2.37 (SD 0.76)	Mean 3.11 (SD 0.74)	Mean 2.68 (SD 0.75)	Mean 2.84 (SD 0.76)	
Brown *et al.* FY1s, 2008 (n=200)	5 point scale (5=very competent, 1=not at all competent)	79.1% rated as 4 or 5	56.4% rated as 4 or 5	40.3% rated as 4 or 5				79% rated as 4 or 5
Tallentire *et al.* FY1s, 2008 (n=36)	4 point scale (1=poor, 4=very good)	Mean 3.53 (SD 0.56)	Mean 2.58 (SD 0.87)	Mean 2.69 (SD 0.86)	Mean 3.14 (SD 0.76)	Mean 3.19 (SD 0.58)	Mean 2.78 (SD 0.68)	
Illing *et al.* Glasgow graduates, 2007 (n=131)	5 point scale with upper end indicating preparedness		Mean 3.443 (SD 0.776)	Mean 2.893 (SD 0.963)			Mean 3.153 (SD 0.898)	Mean 4.420 (SD 0.581)
Illing *et al.* Newcastle graduates, 2007 (n=226)	5 point scale with upper end indicating preparedness		Mean 3.411 (SD 0.810)	Mean 2.982 (SD 0.863)			Mean 3.231 (SD 0.866)	Mean 4.280 (SD 0.646)
Illing *et al.* Warwick graduates, 2007 (n=123)	5 point scale with upper end indicating preparedness		Mean 3.390 (SD 0.685)	Mean 2.983 (SD 0.836)			Mean 3.174 (SD 0.782)	Mean 4.279 (SD 0.695)
Tallentire *et al.* FY1s, 2007 (n=52)	4 point scale (1=poor, 4=very good)	Mean 3.13 (SD 0.68)	Mean 2.52 (SD 0.70)	Mean 2.33 (SD 0.79)	Mean 2.75 (SD 0.82)	Mean 2.92 (SD 0.76)	Mean 2.82 (SD 0.74)	
Brown *et al.* FY2s, 2007 (n=95)	5 point scale (5=very competent, 1=not at all competent)	90.9% rated as 4 or 5	80.3% rated as 4 or 5	54.6% rated as 4 or 5				90.8% rated as 4 or 5
Berridge *et al.* FY1s pre-course, 2005 (n=50)	5 point scale (1=confident, 5=not confident)		Mean 3.26 (median 3, IQR 3-4)	Mean 3.26 (median 3, IQR 3-4)				
Berridge *et al.* FY1s one month post-course, 2005 (n=35)	5 point scale (1=confident, 5=not confident)		Mean 2.46 (median 3, IQR 2-3)	Mean 2.40 (median 2, IQR 2-3)				
Wall *et al.* PRHOs, 2003 (n=193)	6 point scale (1= strongly disagree I am prepared, 6=strongly agree I am prepared)	Mean 4.8834	Mean 4.0337	Mean 4.1839	Mean 4.4767	Mean 4.4508		Mean 4.9922
Clack Graduates, 1985-86 and 1989-90 (n=371)	Course content rated as too much, about right or too little. Attributes rated as yes, partially or no.		57.3% felt they had 'not enough' training	67.6% felt there was 'too little' course time			62.8% felt there had been 'too little' course time	64.4% felt they had the ability to work in a team

Figure 15 - Other healthcare professionals' perceptions of graduate preparedness

First author, respondent group, year of graduation and sample size	Description of Likert scale used	Tomorrow's Doctors (2009) outcomes for graduates (with paragraph number in brackets)						
		Communication (15)	**Acute care** (16)	**Prescribing** (17)	**Practical procedures** (18)	**Information usage** (19)	**Ethics** (20)	**Team-working** (22)
Tallentire *et al.* Consultants, 2009 (n=24)	4 point scale (1=poor, 4=very good)	Mean 2.58 (SD 0.65)	Mean 2.05 (SD 0.72)	Mean 2.22 (SD 0.90)	Mean 2.10 (SD 0.88)	Mean 2.88 (SD 0.74)	Mean 2.65 (SD 0.83)	
Brown *et al.* Consultants, 2008 (n=345)	5 point scale (5=very competent, 1=not at all competent)	63.9% rated FY1s as 4 or 5	30.7% rated FY1s as 4 or 5	39.0% rated FY1s as 4 or 5				48.1% rated FY1s as 4 or 5
Tallentire *et al.* Consultants, 2008 (n=16)	4 point scale (1=poor, 4=very good)	Mean 2.81 (SD 0.75)	Mean 1.86 (SD 0.53)	Mean 2.13 (SD 1.15)	Mean 2.00 (SD 0.68)	Mean 3.06 (SD 0.57)	Mean 2.86 (SD 0.77)	
Illing *et al.* Glasgow team members, 2007 (n=25)	Rating of prepared, unprepared or don't know		16% felt graduates were prepared	72% felt graduates were prepared				80% felt graduates were prepared
Illing *et al.* Newcastle team members, 2007 (n=22)	Rating of prepared, unprepared or don't know		57% felt graduates were prepared	67% felt graduates were prepared				90% felt graduates were prepared
Illing *et al.* Warwick team members, 2007 (n=16)	Rating of prepared, unprepared or don't know		60% felt graduates were prepared	73% felt graduates were prepared				87% felt graduates were prepared
Tallentire *et al.* Consultants, 2007 (n=45)	4 point scale (1=poor, 4=very good)	Mean 2.71 (SD 0.66)	Mean 2.20 (SD 0.68)	Mean 2.09 (SD 0.79)	Mean 2.09 (SD 0.78)	Mean 2.98 (SD 0.74)	Mean 2.48 (SD 0.71)	
Wall *et al.* Consultants, 2003 (n=212)	6 point scale (1= strongly disagree PRHOs, 6= strongly agree PRHOs are prepared)	Mean 4.3986	Mean 3.9552	Mean 3.8066	Mean 4.3703	Mean 4.6203		Mean 4.5778

3.4.4 Concerns relating to preparedness in acute care

Five studies provided information on whether graduates were concerned about preparedness in acute care. The questionnaire used by Goldacre *et al.* in their study of the perceived preparedness of all UK graduates in 2002 and 2005 did not include a question relating to acute care, but free text comments highlighted a desire for more "*acute emergency training*" (Goldacre et al., 2010).

The qualitative arm of the study by Illing *et al.* (2008) collected data using interviews with Foundation doctors at several points during their first year of practice (Illing et al., 2008). At the beginning of their first post,

> "particular concerns were expressed about taking immediate steps with acutely ill patients, although this was seen as tied to the inescapable change in responsibility which comes with being a doctor, and which cannot be directly prepared for" (Illing et al., 2008).

Even at the end of their FY1 year

> "being the first doctor to deal with a sick patient was an area of concern," with some graduates feeling that "having to deal with an acutely unwell patient before senior help arrived had implications for patient safety" (Illing et al., 2008).

Evans *et al.* investigated the "*three main concerns*" (Evans and Roberts, 2006) of three cohorts of graduates from Barts and The London School of Medicine and Dentistry (part of Queen Mary, University of London) shortly before starting work as doctors. In 2000, only 2% of 48 graduates expressed concern about emergency care of patients. However, around 10% of both graduate cohorts in 2004 raised emergency care as one of their top three concerns about starting work (Evans and Roberts, 2006). Only one concern, 'team support', was raised more frequently.

A study by Lempp *et al.* involving interviews with 16 graduates from Guy's, King's and St Thomas' School of Medicine in 2001 revealed that "*stress was related to high personal expectations and competence in emergency situations...*" (Lempp et al., 2004). Matheson *et al.* echoed such findings in their survey evaluation of a four-week preparation for practice course undertaken by 76 graduates of Nottingham

medical school in 2006. Four months after starting work, responses to a free text question asking what else should be included in the course highlighted a desire to learn "*how to respond to on-call emergencies*" (Matheson et al., 2010) and "*what to do with a sick patient*" (Matheson et al., 2010).

3.5 Discussion

This chapter provides an overview of current research on perceived preparedness in acute care and an opportunity to reflect on how it compares to perceived preparedness in other domains, using the framework provided by *Tomorrow's Doctors* (2009). The results suggest that acute care and prescribing are the outcomes in which graduates throughout the UK perceive themselves to be least well prepared for professional practice. Senior colleagues and other healthcare professionals working alongside newly qualified doctors perceive them to be less prepared in acute care than any of the other outcomes. In addition, perceived preparedness in acute care appears to have declined since the first publication of *Tomorrow's Doctors* in 1993. Studies of preparedness for practice which have provided the option of a free text response have consistently shown acute care to be an area of concern for UK graduates.

The preparedness ratings given by newly qualified doctors (Figure 14) are frequently higher than those given by their professional colleagues (Figure 15) across the majority of *Tomorrow's Doctors* (2009) outcomes. This disparity has been noted in chapter 2 and elsewhere (Wall et al., 2006, Jones et al., 2001, Tallentire et al., 2011b), and whilst various authors have offered explanations for the differences, studies exploring this specific issue are lacking. This review highlights that prescribing appears to be an exception, with preparedness ratings given by FY1s consistently lower than those given by healthcare colleagues. A similar review focussing on preparedness in prescribing would help to establish whether this observation is merely an artificial product of the studies investigating preparedness in both acute care and prescribing.

The results presented within this chapter may be of little surprise to those involved in either undergraduate or postgraduate medical training. The care of acutely unwell

patients is complex, involving a myriad of technical and non-technical skills in time-pressured situations and increasingly litigious environments. It is therefore unlikely that new graduates will ever feel completely at ease with acute care; perhaps it is preferable from a patient safety perspective that they do not, prompting them to call for senior help more readily. It is, however, of concern that graduate preparedness in acute care, as perceived by their professional colleagues, compares so unfavourably with preparedness in other outcomes and appears to be trending downwards. All UK medical schools would claim that their graduates can assess acutely unwell patients and instigate generic resuscitative measures, but senior doctors and other healthcare professionals have rated FY1s as unprepared to do so in several recent studies. In their paper published six years ago, Wall *et al.* concluded by asking

> "have the undergraduate curriculum reforms concentrated too much on communication skills to the detriment of basic clinical competencies, such as treatment, prescribing and managing emergencies?" (Wall et al., 2006).

The studies presented in this chapter go some way to providing an answer.

3.5.1 Limitations

By only including studies which contained questions or themes that could be mapped directly onto the outcomes detailed in *Tomorrow's Doctors* (2009), it is possible that this chapter has excluded additional studies containing relevant information, particularly studies that have subdivided outcomes. In addition, the relatively small number of studies included in the review means that only tentative suggestions can be made in relation to trends. Many of the included studies were undertaken by employees of UK medical schools investigating the preparedness of graduates from their own institutions. It is therefore likely that a variety of non-financial internal factors such as departmental pressure to publish, rarely disclosed as competing interests, exerted undue influence on the authors of such studies (Walsh and Sandars, 2008).

The quality scoring of studies was undertaken using BEMEQI as it was considered to be a robust scoring system which was applicable to the field of medical education. However, like all methodological scoring systems, BEMEQI introduces additional

limitations. In particular, the equal weighting of all 11 quality indicators is controversial, with the reliability and validity of data collection methods arguably of paramount importance. Furthermore, the inclusion of 'triangulation' as a quality indicator (i.e. the requirement for the results to be supported by data from other studies) limits the total than can be obtained by original work exploring under-researched areas.

However, the main limitation of this review is the use of a subjective outcome measure; perceived preparedness cannot be assumed to correlate with actual preparedness. Self-assessment is important as the self-regulating nature of the medical profession within the UK relies on the abilities of doctors to identify their own learning needs. However, self-assessment as general and unguided reflection on one's performance is unreliable (Eva and Regehr, 2008). Despite the high face validity of self-preparedness ratings, a systematic review comparing physician self-assessment ratings against independent assessment ratings found that only seven out of 20 studies demonstrated a positive correlation (Davies et al., 2006). The self-assessment ratings provided by newly qualified doctors are likely to have been influenced by the timing of questionnaire distribution. Although all 10 studies included in this review explored preparedness as perceived by newly qualified doctors within their first year of practice, the timings of questionnaire distribution within the first postgraduate year differed substantially. In addition, two of the studies surveyed doctors between one and three years post-graduation (Brown et al., 2010, Goldacre et al., 2010) and one study explored the perceptions of doctors with up to eight years of clinical experience (Clack, 1994). The time-lags in these studies are likely to have altered participants' perceptions of preparedness, with the influence of intervening events being impossible to distinguish.

3.5.2 Conclusion

This chapter has identified several areas requiring further work. Studies that quantify perceived preparedness of graduates across the whole range of *Tomorrow's Doctors* (2009) outcomes are required, in order that medical schools can focus curriculum developments on the areas in which new graduates and their colleagues have

concerns. The literature included in this review suggests that graduates and their clinical colleagues perceive preparedness in acute care to lag behind preparedness ratings mapped onto most other *Tomorrow's Doctors* (2009) outcomes. The results presented in this chapter suggest that recent changes to UK undergraduate training, whilst improving preparedness in some areas, may have under-emphasised acute care skills. Improving perceived preparedness in acute care, along with actual preparedness and the accessibility of senior supervision, is an important component of enhancing patient care and alleviating some of the inevitable anxiety related to the transition between undergraduate training and postgraduate practice. A more detailed understanding of the specific challenges faced by newly qualified doctors in the context of acute care is required in order that tailored educational interventions can be developed. This will be further explored in chapters 4, 5 and 6.

Chapter 4: Understanding the behaviour of newly qualified doctors in acute care contexts

4.1 Introduction

Chapters 2 and 3 have demonstrated that both locally and nationally, a lack of preparedness in acute care is a challenge that warrants further attention. The next three chapters of this thesis strive to develop a detailed understanding of the specific challenges faced by newly qualified doctors in such contexts, in order to guide specific suggestions and targeted educational innovations. Much of the work done in this field to date has been aimed at quantifying preparedness in a single facet of acute care (Smith and Poplett, 2002, Ellison et al., 2008, Moercke and Eika, 2002, Vlugt and Harter, 2002) or involved the evaluation of courses designed to improve acute care skills prior to, or shortly after, commencing work as a doctor (Smith and Poplett, 2004, MacDowall, 2006, Ker et al., 2005, Shah et al., 2008, Carling, 2010). In contrast, the remainder of this thesis aims to explore the complexities of the problem of preparedness in acute care from two different perspectives. This chapter uses reported behaviour as a vehicle for development of a conceptual framework which attempts to illuminate the influences on the behaviour of newly qualified doctors when dealing with acutely unwell patients. Chapters 5 and 6 use the observation and classification of errors to explore specific patterns of behaviour in such contexts.

As previously discussed, the results presented in chapter 2, along with several other similar studies, demonstrate that there is discrepancy between the perceptions of newly qualified doctors and their senior colleagues in relation to preparedness in a variety of domains (Wall et al., 2006, Jones et al., 2001, Probert et al., 2003). As studies comparing the perceptions of these groups in relation to acute care are lacking, this chapter has incorporated the exploration of both perspectives to better elucidate the challenges faced by newly qualified doctors in this specific context.

4.2 Chapter aims

This chapter aims to address the question, 'What factors affect newly qualified doctors' behaviour when caring for acutely unwell patients?' More specifically, it aims to address the following three questions:

1. What are the salient factors identified by newly qualified doctors and their senior colleagues?
2. How do the perceptions of these factors between the two groups compare?
3. How can the emerging themes be used to develop a framework that conceptualises the influences on newly qualified doctors' behaviour in the context of caring for acutely unwell patients?

4.3 Methods

4.3.1 Setting

As detailed in chapter 2, approximately half of the FY1 and FY2 doctors working in South East Scotland have undergone training at the University of Edinburgh, with the other half having migrated from a wide range of undergraduate medical courses. In South East Scotland, FY1 doctors do not work within the Emergency Department and the results and discussion in this chapter are therefore restricted to the care of acutely unwell ward patients.

4.3.2 Design

The work was conducted using focus groups in combination with grounded theory methodology. In contrast with other forms of interview, focus groups allow discussion of complex topics with an emphasis on the interactions between research participants to generate data and explore why participants think the way they do (Kitzinger, 1995, Morgan, 1988). Grounded theory originated from the work of Glaser and Strauss and describes an inductive method which aims to advance knowledge through the generation of new theories that are 'grounded' in a systematic analysis of the data (Glaser and Strauss, 1967). It is therefore suited to studies addressing poorly understood topics where there is a dearth of existing theory. This chapter employs the constructivist approach to grounded theory methodology first

developed by Charmaz (Charmaz, 2000, Charmaz, 2006). In contrast to the assertion of Glaser and Strauss that theories are 'discovered' from the data, Charmaz argues that grounded theories are 'constructed' (Charmaz, 2000). She holds the view that the interplay between researcher and participants is central to the construction of theory, which itself represents an "*interpretive portrayal of the studied world*" (Charmaz, 2006) and not an exact replica of it.

4.3.3 Sampling

A theoretical sampling model was used to seek volunteers via email from three separate groups: consultant and SpR grade doctors ('seniors'), FY2 doctors and FY1 doctors (Kuzel, 1999). Emails to FY1 and FY2 doctors were sent via the education co-ordinators in the two local teaching hospitals and emails to senior doctors were distributed using University-based lists of Foundation doctor supervisors. Both emails outlined the purpose of the work and indicated the activity and likely time commitment involved. All senior doctors were required to be both actively involved in the supervision of Foundation doctors and have regular clinical exposure to acutely unwell patients. The categorisation of doctors into three groups produced cohorts of individuals with similar clinical experience that were likely to have differing views in relation to the first research question (Mays and Pope, 1995). The groupings meant that peer group perspectives could be elicited, analysed individually and compared.

4.3.4 Data collection

Between September and December 2009, a total of six focus groups were undertaken, two with each group of doctors. Each focus group had between four and eight participants. Groups lasted between 70 and 95 minutes and, with the consent of all participants, were audio-recorded. A copy of the consent form completed by participants is shown in Appendix 4.

To initiate discussion, participants were asked the following open questions:

- What factors do you feel affect newly qualified doctors' behaviour when caring for acutely unwell patients?

- How do newly qualified doctors cope when faced with an acutely unwell patient?
- In what ways does their undergraduate training prepare them to deliver care to an acutely unwell patient?

As the session developed, inconsistencies between participants were highlighted and used as a basis for individuals to clarify why they held certain views or beliefs (Barbour, 2005, Kitzinger, 1995). Participants were encouraged to exchange ideas and anecdotes, and comment on each other's experiences and views (Kitzinger, 1994). The full focus group schedule is shown in Appendix 5. Field notes were taken during and immediately following the groups' discussions.

4.3.5 Analysis

The focus group recordings were transcribed verbatim and analysis was conducted using the audio-recordings, transcripts and field notes. Coding and categorisation were undertaken using NVivo 8 software which facilitates development of a cross-group thematic framework whilst allowing continually checking of the contextual validity of individual comments or excerpts of discussion (Ritchie and Lewis, 2003). Analysis of early focus groups commenced in parallel with continued data collection, in order to allow deeper exploration of emerging themes with subsequent participants (Charmaz, 2006). As emergent themes were identified, particular attention was paid to affording comparisons between groups as well as the process and pattern of discussion to highlight non-consensus or contradictory views that may not be represented in group summaries (Barbour, 2005, Mays and Pope, 2000). Codes were assigned to emerging areas of interest, which were continually renamed, reshuffled and redefined to build a thematic grid (Kennedy and Lingard, 2006). SES re-coded three of the six focus group transcripts and differences were discussed, new themes identified and theme names and descriptions refined until agreement on the coding system was reached (Charmaz, 2006). When categorisation was complete, axial coding was performed to elicit overarching themes and promote exploration of the relationships between emergent themes.

4.3.6 Validation

During the process of data analysis, a conceptual framework incorporating the emergent themes and the relationships between them was gradually developed and refined. Following the development of an initial framework, meetings were arranged with nine of the participants to discuss the associations of emergent themes and compare the researcher's interpretation with that of participants (Mays and Pope, 2000). Participants were selected for the validation exercise on the basis of diversity of opinion expressed at the focus groups. Whilst it was hoped that the process of data analysis had allowed the researcher to reach a higher level of abstraction than the participants, the validation process helped to ensure that the themes and associations resonated with the participants and had not been recast into

> "a lifeless language that better fits **our** academic and bureaucratic worlds than those of our participants" (Charmaz, 2006) [original emphasis].

Detailed field notes were taken and interviewees were encouraged to sketch new ideas and annotate the evolving framework. Several suggestions of unexplored associations prompted the researchers to return to the data for further analysis. If no evidence of an association was found in the transcribed focus group discussions, the new data generated from respondent validation was considered for incorporation into the framework (Mays and Pope, 2000).

4.4 Results

A total of 36 doctors participated in six focus groups; 13 'seniors', 12 FY2 doctors and 11 FY1 doctors. The final two focus groups (one with seniors and one with FY2 doctors) yielded no new themes (Charmaz, 2006, Morse, 1995). Responses from the FY1 and FY2 focus groups showed no apparent differences and are therefore considered together as 'juniors'. The developing framework was discussed with nine of the participants; four seniors and five juniors. Three main themes emerged from the focus group data: 'cognitive challenges', 'role and responsibility' and 'environmental factors'. The differences in perception and emphasis in relation to each of the themes between the juniors and the seniors are highlighted and subsequently discussed.

'Cognitive challenges' refers to the thought processes involved in the clinical assessment, investigation and management of the patient. 'Role and responsibility' refers to the individual's place within the organisation, and the expectations (of self and others) that accompany that position. 'Environmental factors' refers to the context within which the individual is working, both in terms of specific situational factors and organisational structure.

4.4.1 Cognitive challenges

4.4.1.1 Transferring knowledge into practice

Using a variety of different examples, both the junior and senior doctors emphasised the difficulties associated with translating theoretical knowledge into practice. The importance of a structured patient assessment was repeatedly emphasised by seniors and the apparent lack of structure was often attributed to lack of rehearsal.

> Senior 11: "They kind of know the A to E structure to talk about it, but they actually don't apply it. They get the concept; they just haven't practised it enough."

> Senior 9: "That's why scenario training and rehearsal is hugely helpful to actually put them through their paces. It's one thing to have an algorithm and learn it from a book...it's a completely different thing to put it into practice."

The juniors also felt that translating theoretical knowledge into practice, particularly in relation to applying a structured approach to patient assessment, presented a challenge. They stressed that when asked about the care of an acutely unwell patient, either in an examination or informal discussion, they were able to provide a structured answer demonstrating a logical sequence of assessment and appropriate initial management. Whilst acknowledging that rehearsal may help to 'bridge the gap', they also felt that they often knew what to do, both in terms of assessment and management, just not **how** to do it.

> Junior 3: "ABC is like 'mirrors, signal, manoeuvre', at driving school. Any four year old can repeat the words 'mirror, signal, manoeuvre' but it's very different actually doing it... we had so few opportunities to actually practise it."

> Junior 6: "Yeah, medical school doesn't really prepare you for being an FY1, it's completely different you know... I knew what to do, I just didn't know how to actually do it, I wasn't prepared in a practical sense at all."
>
> Junior 3: "Exactly! Like the bradycardia I saw the other day... I knew as a medical student that I needed to give atropine but I had never seen it, never drawn it up, never had to actually give it, so that knowledge isn't in a form you can use it."

4.4.1.2 Decision-making and uncertainty

Acutely unwell patients often require empirical resuscitative measures to be instigated concurrently with investigations which aim to characterise the nature of the illness and ultimately reach a definitive diagnosis. The seniors found what they called the "*history, examination, then do something*" attitude of the juniors a source of great frustration, whilst the juniors frequently commented on how unfamiliar and uncomfortable it felt to initiate treatment without knowing the patient's diagnosis. They also described a process of trying to 'guess' the diagnosis when only a cursory assessment had been made, in order to try to work out which treatment was appropriate. Once they had thought of a diagnosis, they often found themselves fixated on it, even when additional examination findings and investigation results were inconsistent with their hypothesis.

> Junior 11: "It is a totally new concept to have to run without a diagnosis. Once you have a diagnosis in your head it is impossible to move away from that and consider other things, you just continue, you know, down the same path."

Several juniors described distraction techniques, such as focussing on the completion of a specific task, employed in order to avoid facing difficult decisions in the context of diagnostic uncertainty.

> Junior 23: "...well, it makes you feel like you are doing something. If you are rushing around finding a venflon [intravenous cannula] and putting it in, then you can't really focus on the fact that you don't know what's going on, or the patient can't breathe. It's the urge to actually do something in the acute situations, so we do the things, well the things that we know how to do and don't really need to think about."

4.4.2 Role and responsibility

4.4.2.1 Acts and omissions

The reluctance to make decisions was closely associated with the belief that **causing** harm to the patient by making an egregious error was in some way worse than allowing harm to happen by omitting an action or failing to initiate treatment.

> Junior 5: "You suddenly realise that you could kill someone. You could make them better, which is obviously what you are trying to do, but you are afraid that if you do something wrong then you could kill them faster than if you'd done nothing."

> Junior 10: "Yeah, I think that is a lot of what underlies a lot of the time wasting in an acute situation. People are afraid of doing something that will have a bad outcome so they just write the notes or put in another venflon."

The overwhelming desire to 'do no harm' appeared to stem from undergraduate training and the emphasis on being aware of one's own limitations.

> Junior 15: "The teaching sort of instils behaviours in doctors... at the moment it focuses on 'don't do anything that you're not sure of, don't ever be out of your depth' but perhaps we need to teach that in some situations you do need to act, and take responsibility, and messing up is better than doing nothing sometimes."

4.4.2.2 Identity and expectations

The juniors described some uncertainty about their new roles, often precipitated by a disparity between the level of responsibility imposed on them, and that which they felt happy to accept. On the one hand they considered themselves to be responsible solely for ensuring that a patient survived until senior help arrived, yet on the other they felt that they were abdicating responsibility if they did not attempt to assess, investigate, diagnose and treat a patient before calling for help. The juniors often judged their behaviour against their expectations of themselves and what they believed a doctor should be able to do.

> Junior 7: "You don't want to phone for help and them say "what have you done?" and you have to say "nothing". Because that would make you feel useless. And you feel like

'I'm a doctor now, I should be able to at least start to manage a situation'."

As well as judging themselves against their own expectations, the juniors also judged their behaviour against their perceptions of the expectations of senior colleagues. They described being reluctant to call for help if they hadn't undertaken simple investigations, as they feared falling short of their senior colleagues' expectations.

> Junior 9: "Sometimes as an FY1 you worry that someone won't be happy that you've called them, and got them to come. You think 'maybe I should just do an ABG [arterial blood gas], they won't be happy if I haven't done that'. And you think you have to do all these things to prove that you have tried, when actually you should just phone."

The seniors recognised the reluctance of their junior colleagues to call for help, which they attributed to a variety of different factors: role-modelling, concern about unfavourable comparisons to predecessors or, paradoxically, a desire to **exceed** senior colleagues' expectations.

> Senior 6: "We're not very good at asking each other for help, are we? ... as a consultant I'm not good at asking for help; I've been in the resus [resuscitation] room and thought 'I could really do with a help' and hadn't realised it until really you've been with the patient too long."

> Senior 3: "There's this prevailing attitude that FY1s are up against; that trainees aren't as good now as they were in the past. That's tough for them. Perhaps that is why they seek out hard evidence before calling for help..."

> Senior 4: "My feeling is that after the medical school process, it's very difficult to get them out of the mentality that they are there to perform, and shine, on their own."

4.4.3 Environmental factors

4.4.3.1 The medical hierarchy

The language used by the juniors when referring to their senior colleagues was characterised by military analogies, with references to *"battle"*, being the *"foot soldiers"* who are *"shot down"*, require *"armour"* for protection and *"take orders"*.

> Junior 2: "One of the problems is that when people call early for help, sometimes they get blown out for doing it, because the person on the other end wants to know lots of information that you don't have... so people shy away from making the call until they feel that they have enough armour, in the form of knowledge that is going to be demanded from them, to come out of the call unscathed."
>
> Junior 11: "I didn't quite realise until I started how hierarchical medicine is... as soon as you are in the system as a junior, you realise that actually it hasn't really changed that much. We are the foot soldiers. And you jump when people say jump. And you don't talk back. And you don't question things. So speaking in a forceful manner in an acute situation to a 'superior officer' goes against the grain and you know that you are going to be in big trouble if you do it."

Whilst the seniors did acknowledge the presence of a hierarchy, they felt that it was confined to surgical specialties, whereas the juniors described it as a barrier to seeking help in all contexts.

4.4.3.2 Performing under stress

Dealing with acutely unwell patients is one of the most demanding facets of a junior doctor's workload due to the fact that it involves situations characterised by time pressure, high stakes outcomes, heavy information load and dynamic conditions. The juniors frequently described feeling overwhelmed and even paralysed by the stress of having to manage an acutely unwell patient and articulated the impact of stress on their behaviour.

> Junior 1: "When you start as an FY1 and someone gets unwell, you think they are going to die in seconds. And so you panic. But very rarely is that actually the case. You have got time to think about what you are doing. You have more than ten seconds; you have got a little longer than you think."
>
> Junior 5: "We need better referring skills... in acute situations that is really difficult."
>
> Junior 2: "...the stress of that situation, that's what makes it hard... You know what you need to say, but the reality is that you panic."

Links to the cognitive challenges described earlier became increasingly evident as the junior doctors described how the presence of diagnostic uncertainty exacerbated stress, which in turn impacted on decision-making ability.

> Junior 7: "I met personal brick walls very quickly at the beginning, of not knowing what to do next, because panic would set in."

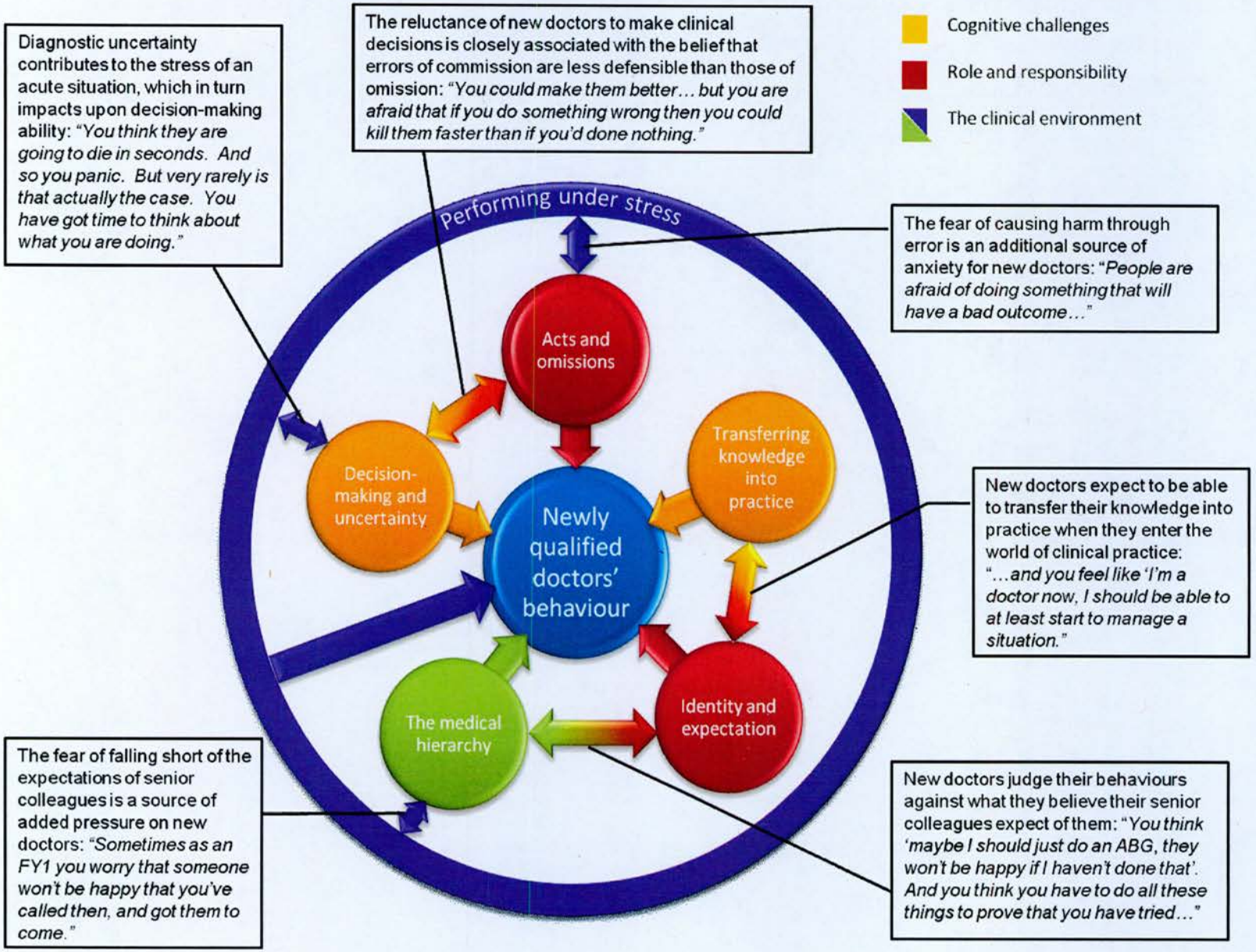
The seniors appreciated that the juniors found acute situations stressful, but seemed to regard the emotional response as a transient, restrictive state rather than the pervasive, debilitating state described by their junior colleagues.

> Senior 4: "We are never going to produce an FY1 who can step back, take it all in and calmly consider the situation... the best that we can get is to equip them to go onto 'automatic pilot' in an efficient way... it's almost teaching them to 'tread water' until their anxiety subsides to a level where they can think again."

4.4.4 Construction of a conceptual framework

During the iterative process of data analysis and subsequent respondent validation, it became increasingly evident that the three themes, whilst presented here individually and sequentially, interact and overlap in complex ways. This constant interplay between the themes is an essential component of the framework shown in Figure 16. The framework includes only relationships which can be justified by the data. Each association is denoted by an arrow with further detail and illustrative quotes in the adjacent text boxes. The unlabelled arrows represent the direct influence of the six themes described above on the behaviour of newly qualified doctors. The emphasis on behaviour, as opposed to attitudes, knowledge, or any other facet of competence or professionalism is based on the assumption that it is what a doctor **does** - as opposed to what they know, think or feel - that primarily impacts on patient outcome.

Figure 16 - A conceptual framework illustrating the major influences, and their inter-relationships, on the behaviour of newly qualified doctors caring for acutely unwell patients



4.5 Discussion

The conceptual framework presented within this chapter is an interpretation of the data *produced* by, as opposed to discovered from, the interactions between the researcher and participants (Charmaz, 2000). As discussed in chapter 1, the concept of an objective reality (positivism) has been rejected and in its place there lies a belief that meaning is context specific. Grounded theory methodology has undergone a process of evolution since its inception in the 1960s, described as a "*methodological spiral*" (Mills et al., 2006) which has mirrored the epistemological trends of educational research more generally. Despite its rising popularity, Glaser and others continue to dispute the existence of constructivist grounded theory, with arguments firmly situated within a post-positivist framework maintaining that participant interpretation (rather than mutual interpretation) is of paramount importance (Glaser, 2002).

The framework presented in Figure 16 fulfils Charmaz's definition of theory; it is constructed from themes which are separated from, but grounded in, the data and relate to each other at a theoretical level (Charmaz, 2006). In producing the framework, VRT does not seek to *explain* or *predict* using linear reasoning (as do positivist theories), but rather to *understand* complexity by emphasising connections and relationships (Charmaz, 2006). Critics of grounded theory have argued that it merely leads to generic, decontextualised explanations (Burawoy, 1991). However, whilst that criticism may be true of objectivist grounded theory (which strives to discover a generalisable explanation), constructivist grounded theory is inextricably linked to its context having been co-produced by the researcher and their participants.

The three themes of 'cognitive challenges', 'role and responsibility' and 'environmental factors' may be explored with reference to contemporary debate surrounding dominant learning theories and trends within medical education. The theme of 'cognitive challenges' resonates with recent interest in cognitive and metacognitive strategies and their potential to reduce medical error (Croskerry, 2003b, Croskerry, 2003a) and improve patient outcomes (Dunphy et al., 2010). Such

theories might be incorporated into medical and nursing curricula by focussing on improving situation awareness. The conventional model of situation awareness, first described in military and aviation settings but subsequently adapted for anaesthesia (Gaba et al., 1995), is based on the internalised processes of an individual and their assimilation of all available information. Good situation awareness, along with adequate knowledge, is recognised as an essential precursor to safe decision-making, particularly in time-pressured and high stakes situations (Flin et al., 2008).

Whilst the exciting potential of metacognitive strategies to modify flawed clinical reasoning and reduce medical error is acknowledged, recent medical education research compels us to look beyond the individual. The theme of 'role and responsibility' emerging in this chapter supports other studies which have concluded that much of the anxiety characterising the transition from medical student to doctor can be attributed to feeling forced to take responsibility and the uncertainties of a new role (Illing et al., 2008, Paice et al., 2002). Other recent work has highlighted the importance of identity issues and organisational factors in the origins of trainees' desires to demonstrate clinical independence and avoid seeking help (Kennedy et al., 2009). Resonating with the work detailed in this chapter, Stewart's work on the influences on a junior doctor's response to a judgement call within a clinical setting highlighted the tension between trainees' desires to "*progress and develop towards independent practice*" (Stewart, 2008) and their responsibility to provide the best possible care for their patients. Situated learning models conceptualise learning as not only the accumulation of knowledge and skills, but also the development of a new identity as a member of a particular "community of practice" (Lave and Wenger, 1991). In their desire to embrace the identity of a master practitioner, junior doctors may feel compelled to assess and manage acutely unwell patients alone, as they have seen others do (Kennedy et al., 2009) ("*as a consultant I'm not good at asking for help*").

A limitation of Lave and Wenger's theory as applied to this particular context is that it speaks only of apprenticeship and communities of practice (characterised by "shared repertoire"), with learners progressing gradually from novice to expert or "master" (Lave and Wenger, 1991, Wenger, 1998). In contrast to this gradual

transition of responsibility, however, the culture of hospital medicine can be characterised by rigid hierarchy, frequently with obsequious juniors and unquestioning deference to authority. Such environments provide rich breeding grounds for error, particularly when combined with the effects of fatigue, time pressure and stress on cognition deployment (a variant of the speed/accuracy trade-off from the discipline of human factors) (Pani and Chariker, 2004, Flin et al., 2008, LeBlanc, 2009). The challenge in hospital medicine is to consider how junior doctors can be encouraged to develop their professional identities by gradual acquisition of responsibility, whilst at the same time improving patient safety by promoting the questioning of decisions and procedures that the more "peripheral" learners observe being undertaken by their senior colleagues.

The emergence of 'environmental factors' as the third theme, and the interplay between the themes in the framework, emphasise the complex reality of clinical medicine. The results described in this chapter highlight both the detrimental effects of stress on cognition (LeBlanc, 2009) ("*not knowing what to do next, because panic would set in*") and the human tendency for attention to become so focussed on one aspect of a situation that other cues are not noticed (Flin et al., 2008) ("*it is impossible to move away from that and consider other things*"). Similar demonstrations of the fallibility of human perceptual and memory systems have led to a call for medicine and medical training to adopt more distributed approaches to situation awareness (Bleakley, 2010). A distributed cognition approach to medical decision-making recognises that a junior doctor's decisions do not occur in isolation but are transformed by the dynamic interaction between the junior doctor, the patient, other members of the healthcare team and additional external artefacts (Fioratou et al., 2010). The data tell us, however, that junior doctors' decisions and behaviours are also influenced by the prevailing culture of the organisation and their perception of the hierarchy within which they work. In medical practice there remains a misconception, by juniors and seniors alike, that calling for help is synonymous with failing to cope. The junior doctors' descriptions of wrestling with both the anxiety of being directly responsible for patient harm and the dread of being reprimanded by a senior colleague are sobering. Newly qualified doctors enter into a community of

practice that continues to confuse error and blameless failure, having received little guidance on how to respond emotionally to either situation (Pani and Chariker, 2004).

4.5.1 Limitations

This chapter incorporates different perspectives gleaned from individuals involved in the delivery of acute care to develop a conceptual framework that is grounded in empirical data and supported by work within and outwith the discipline of medical education. The incorporation of doctors from a variety of medical schools means that the perspective is broader than that obtained from a single institution. The work is, however, limited by several methodological factors. Any work that employs volunteers risks sampling those with particularly strong views or a specific personality type, factors which are also likely to affect their care of acutely unwell patients. In addition, the relatively small sample size limits claims of theoretical saturation (Morse, 1995). Separating participants reflecting on their own delivery of care (the junior doctors) from those primarily discussing other, less experienced doctors' abilities aimed to facilitate uninhibited discussion and capitalise on shared experiences to promote a feeling of community (Kitzinger, 1995). However, it is also of note that focus groups may serve to silence dissenters and those who feel that their own inadequacies contribute to the problems under discussion (Kitzinger, 1995). The public nature of the discussion may have prevented the deep exploration of individual emotional and behavioural elements, particularly those that contravened group norms (Kitzinger, 1995, Dicicco-Bloom and Crabtree, 2006).

All participants involved in the work detailed in this chapter were doctors. Other groups such as nursing staff and patients may offer different perspectives which could enrich the data and further develop the framework. The juniors' responses suffer from all of the well-documented shortcomings of retrospective self-assessment, particularly when it takes the form of unguided reflection on one's performance (Davies et al., 2006, Eva and Regehr, 2008). Furthermore, the seniors may not have been sufficiently familiar with undergraduate training to adequately contextualise their comments and suggestions. It is hoped, however, that the

comparison of junior and senior doctors' responses may, at least in part, offset these group-specific limitations.

As with all forms of interview, the collection and analysis of data is influenced by the social context of the focus group including the order, structure and language of the questions posed and the inherent power dynamics that are particularly prominent within the hierarchy of clinical medicine (Reeves et al., 2006). VRT is a clinician and is therefore embedded within this hierarchy as a senior colleague of some participants, and a junior colleague or contemporary of others. Rather than reducing the validity of the data, however, the use of constructivist grounded theory has allowed the relationships between researcher and participants to be embraced. The data and theory presented is inseparable from the context in which it was constructed, and to that end represents not only the participants' views but also encompasses the experiences and ideas of VRT.

4.5.2 Conclusion

The work detailed in this chapter adds to existing literature which emphasises the complex interplay of emotion, affect, decision-making and behaviour (Croskerry et al., 2010). Medical training and assessment structures currently emphasise and reward personal knowledge and academic attainment above collaboration and emotional maturity. In the drive to improve patient safety, a key component is to nurture doctors who understand human fallibility and feel empowered to ask for help, safe in the knowledge that they will not be deemed to have failed. Such concepts will be explored from the alternative perspective of error in chapters 5 and 6.

Chapter 5: Observing and categorising error in team-based acute care

5.1 Introduction

The review detailed in chapter 3 has highlighted that acute care is an area in which newly qualified doctors feel consistently poorly prepared. This perception is supported by data suggesting that patients admitted on the day that junior doctors commence work in the UK have an in-hospital death rate six percent higher than those admitted a week previously (Jen et al., 2009). The combination of time pressure, dynamic conditions and heavy information load afforded by acute situations provides fertile ground for error (Flin et al., 2008, LeBlanc, 2009). Designed to complement the work detailed previously, chapters 5 and 6 of this thesis explore the errors made by newly qualified doctors in acute care in order to further illuminate the complexities and specific challenges involved.

The causes of medical error are diverse and complex, involving both individual and systems factors (Kohn et al., 2000). As the contribution of human error to sub-optimal healthcare outcomes is increasingly understood, a plethora of error modelling frameworks and taxonomies have been developed which attempt to facilitate deeper exploration and understanding (Battles and Shea, 2001, Molloy and O'Boyle, 2005, Zhang et al., 2004). However, much of the contemporary discourse within the medical education literature in relation to medical error emphasizes diagnostic error (Eva et al., 2010, Berner and Graber, 2008, Norman and Eva, 2010, Eva, 2009, Croskerry, 2009a, Croskerry, 2009b), despite the fact that "*diagnostic reasoning is only one part of the equation*" (Jolly and Atkinson, 2010). As discussed in chapter 4, one of the unique challenges of acute care is the necessity to instigate generic resuscitative measures whilst concurrently collating clinical information to aid diagnosis and guide specific management. In the context of hospital inpatients, diagnosis formation may be either aided or hindered by prior knowledge of a patient's condition, which may not necessarily be relevant to the acute deterioration. Consequently, the exploration of errors made in acute care contexts should not start with diagnosis but rather explore all of the actions undertaken during initial

assessment and treatment. The cognitive processes underlying other decisions such as seeking help, judgement of illness severity and initial investigation choice may provide new insights into the causes of clinical error in the context of acute care. An additional challenge in the care of acutely unwell patients is the fact that doctors rarely make decisions in isolation, but instead tend to work in teams to plan and provide initial resuscitation and on-going care.

The conceptual framework used in this chapter is the generic error-modelling system (GEMS) devised by James Reason (Reason, 1990), but heavily influenced by Rasmussen's skill-rule-knowledge classification of human performance (Rasmussen and Jensen, 1974). GEMS was chosen because it provides a practical and logical framework which recognises the importance of both observed behaviour and cognitive processing. Since its inception, GEMS has been developed in a variety of ways, including subdivision of the categories (Reason, 2008), and amalgamation with other conceptual frameworks (Zhang et al., 2004). Such modifications have been particularly useful in the context of systems improvement (Leape et al., 1995, Molloy and O'Boyle, 2005), but seem less applicable to error exploration as a means of driving educational innovation at the level of the individual, where theoretical detail can dilute the potential for practical application. Consequently, the original broad version of GEMS was utilised in this chapter. A recent study by Dornan *et al.* employed the same broad framework to categorise prescribing errors using information obtained during critical incident debriefing (Dornan et al., 2009). Other studies have also identified the value of retaining broad classifications, although such work has thus far been restricted to the field of prescribing (Dean et al., 2002, Leape et al., 1995), an activity which is often undertaken alone and rarely involves the complex, multi-modal interactions observable in team-based acute care.

Definitions, explanations and examples of the four error types described by Reason are given in Figure 17. Skill-based slips and lapses, rule-based mistakes (RBMs) and knowledge-based mistakes (KBMs) are all types of *unintentional* error (Reason, 1990). Violations are *intentional* aberrant behaviours which, unlike the other error types, are judged against the social and organisational context within which actions occur and not merely against one's own intentions (Reason, 1990).

Figure 17 - Definitions, explanations and examples of the error types described in Reason's generic error-modelling system (GEMS)

Error type	Definition	Explanation	Everyday example
Skill-based slips and lapses	"*errors which result from some failure in the execution* [slip] *and/or storage* [lapse] *stage of an action sequence*" (Reason, 1990)	Slips are often caused by attention failures during a task whereas lapses result from memory-failure prior to task commencement.	Your guest would like tea and you prefer coffee. You walk into the kitchen intending to make the correct drinks, but return with two cups of coffee.
Rule-based mistakes (RBMs)	"*the mistake arises from the application of a 'bad' rule or the misapplication of a 'good' rule* [a rule of proven worth]" (Reason, 1990)	A rule formed from prior experience or existing knowledge is either misapplied or is inherently flawed.	Piles of paper to be recycled are left next to the front door. You put a pile of papers left there in the recycling bin, only to discover that your partner left them by the door as a reminder to take them to a meeting.
Knowledge-based mistakes (KBMs)	Mistakes arising from "*the more laborious mode of making inferences from knowledge-based mental models of the problem space*" (Reason, 1990)	Attempts to pattern-match have failed and a lack of pre-programmed solutions necessitates effortful, conscious processing.	You are attempting to bake a cake for the first time. You do not realise that the oven door should remain closed and half way through the baking time you open the oven door to check the progress, causing your cake to sink.
Violations	"*deliberate – but not necessarily reprehensible – deviations from those practices deemed necessary to maintain the safe operation of a potentially hazardous system*" (Reason, 1990)	Intentional deviations from correct protocols or routine courses of action, often in an effort to save time or effort by taking "shortcuts".	You are late for an important meeting and are held up for ten minutes by a slow-moving bus. After overtaking the bus you drive slightly over the speed limit for the remainder of the journey.

5.2 Chapter aims

In preparation for the work that follows, this chapter aims to answer the following questions:

1. Can GEMS be used to classify the errors made by junior doctors working in small teams, using simulated acute care scenarios to provide the contextualised data?

2. How can the framework be amplified to accurately reflect the range of errors made by junior doctors working in small teams?

5.3 Methods

5.3.1 Setting and population

Newly qualified doctors in South East Scotland undertake a three-day induction programme immediately prior to commencing work. Participation in data collection for this chapter was an optional component of the induction programme delivered in August 2010 at the Western General Hospital in Edinburgh. With the prior agreement of the Associate Dean for Foundation Training in the South East Scotland deanery and the Director of Medical Education in NHS Lothian, all junior doctors due to commence work at the Western General Hospital were invited to take part via email.

5.3.2 Design

Whilst the observation of authentic clinical practice is limited by both practical difficulties and ethically unjustifiable patient safety implications, simulated scenarios allow the observation of clinical skills, behaviours and responses in an environment that does not expose patients to harm. High fidelity simulation was thus employed to provide the contextualised data for this chapter, rather than in its more usual role as an educational tool. Between January and July 2010, eight simulated scenarios involving acutely unwell patients were designed and electronically programmed by VRT and two other clinicians. All scenarios were repeatedly piloted using a total of 16 junior doctors who were not participants. The junior doctors provided feedback on the difficulty and clinical credibility of the scenarios, and the programming was

refined to create scenarios that were reproducible and realistic. The four ward-based scenarios used for this chapter were those which performed most consistently and received the most positive feedback in the pilots: post-operative haemorrhage, severe sepsis, post-operative respiratory distress and hypoglycaemic coma.

The simulated environment consisted of a single full-body adult mannequin simulator (Emergency Care Simulator, Medical Education Technologies Inc.) accompanied by the monitoring equipment, drugs and other supplies usually available on a general medical or surgical ward. Three ceiling-mounted cameras allowed the scenario to be filmed from a variety of perspectives and relayed real-time to the control room. The fidelity of the simulated patient was enhanced by a patient voice transmitted via a wireless microphone, dynamic physiology and realistic clinical examination findings. A bedside monitor provided physiological parameters when requested by participants. A telephone handset was connected directly to the control room, and a resuscitation officer previously unknown to the participants played the role of a ward nurse, capable of a finite, pre-defined range of tasks. As this chapter focuses on the errors made by the junior doctors, the nurse helper neither provoked nor prevented errors from occurring, but provided accurate and helpful advice whenever it was requested.

5.3.3 Data collection

The consent form completed by all participants is shown in Appendix 6. Following a briefing which covered room lay-out, nurse helper capabilities and mannequin features and limitations, the junior doctors were placed in groups of two or three. They were given information regarding the patient's age, reason for admission to hospital and current presenting symptom, and were then invited to assess and treat the patient (mannequin) within the simulated setting. Observation of participants in teams rather than alone replicated the realities of clinical practice and encouraged verbalisation of decisions and ideas. Each simulated scenario lasted between 20 and 25 minutes and was video-recorded (with audio). It was immediately followed by an audio-recorded debrief lasting between 30 and 40 minutes which was conducted by VRT or one of two other trained senior clinicians. Debriefing was aided by

immediate playback of the scenario, and encouraged articulation of the cognitive processes which had occurred, particularly in relation to the errors observed. Field notes were taken during and immediately following both the simulated scenarios and the debrief discussions.

5.3.4 Analysis

Analysis was conducted using the scenario video-recordings, debrief audio-recordings and field notes. The video recordings of all 18 scenarios were reviewed by VRT and SES. During video review, identification of an error prompted pausing of the video and discussion of the error in detail, informed by referral to current resuscitation guidelines. All errors were attributed to the team of doctors, rather than a single participant, except when evidence existed for the same error having been made by more than one participant for different reasons. In such cases, the richness of the data was preserved by giving individual consideration to the actions of each participant, recorded as distinct errors. Observation of a single participant involved noting aspects of behaviour, along with verbal and body language clues which helped to explain erroneous actions.

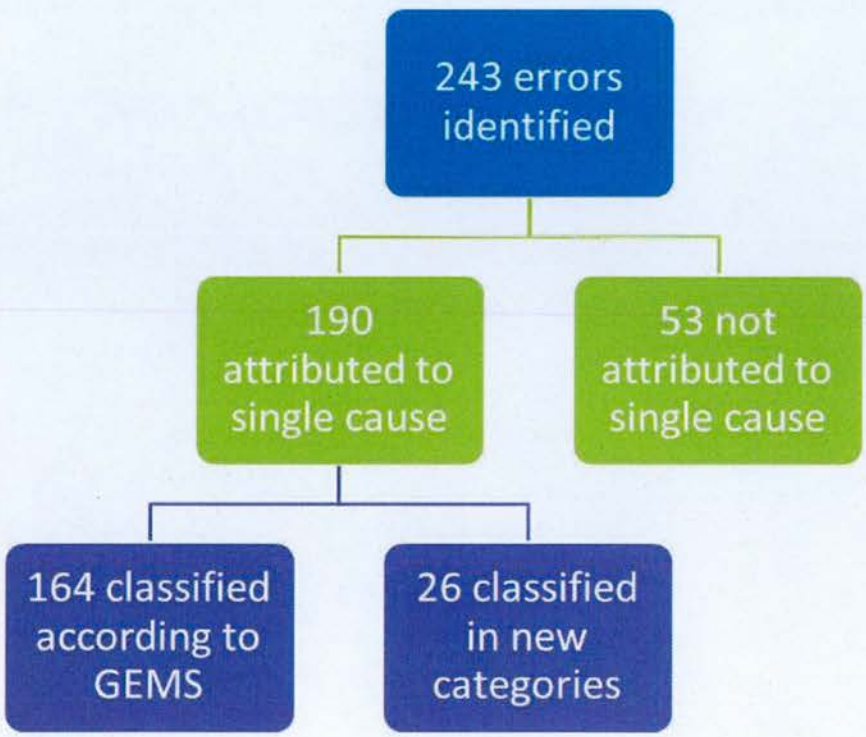
Immediately following review of each video recording, VRT and SES listened to the audio-recording of the corresponding debrief in an attempt to glean additional information pertaining to intention. Audio-recordings were chosen in preference to transcriptions as the presence of intonation or emphasis helped to more accurately interpret the meaning of some participant comments or questions. Following assimilation of the evidence, each error was reviewed in the context of the scenario and debrief to determine whether there was sufficient evidence to attribute the error to a single cause. In cases where a single cause was evident, the error was coded into the GEMS framework by template analysis (King, 1998). Errors which could not be coded into the GEMS framework were coded inductively.

5.4 Results

All 38 junior doctors who were invited to be involved participated in 18 simulated scenarios in pairs or threes. Participants included graduates from seven UK medical schools. In total, 243 errors were identified (ranging between eight and 20 errors per scenario). Sufficient evidence was available to attribute 190 of the errors to a single cause. For the 53 remaining errors, there was insufficient evidence from the scenario, debrief and field notes to confidently attribute the error to one of a number of possible explanations.

It was possible to classify 164 of the errors according to GEMS without modification to the framework. An additional 26 errors were classified in new categories which are proposed overleaf as an amplification of GEMS when used in a team-based context. Figure 18 is a visual representation of the errors classification process.

Figure 18 - Classification of the 243 errors identified by video analysis



5.4.1 Uncoded errors

In relation to 53 of the 243 errors, there was insufficient evidence from the scenario, debrief and field notes to confidently attribute them to one of a number of possible explanations. One frequently identified example of such an error was the failure to wear gloves for intravenous cannula insertion. As this omission was neither discussed by participants during the scenario, nor mentioned in the debrief, it is possible that it was a lapse (junior doctor intended to wear gloves but forgot), a RBM (for example, application of the bad rule 'gloves are not important in emergencies') or a KBM (junior doctor unaware of the importance of gloves for infection control). Consequently, such errors could not be coded into the GEMS framework.

5.4.2 The existing framework

Slips relate to the execution phase of a task whereas lapses result from failure of the storage phase and usually occurred when there was either a time lag or distraction between the formulation and execution of the plan. RBMs stemming from both the misapplication of 'good' rules (those with proven utility in a particular context) and the application of 'bad' rules were identified. Good rules were often misapplied when the clinical situations presented to the junior doctors shared some common features with the circumstances in which the chosen rules are pertinent. The clinical features which indicated that the rule being applied was inappropriate tended to be ignored by the junior doctors.

KBMs were, by definition, associated with situations that the junior doctors had not previously encountered. They related to many forms of knowledge including clinical aspects, hospital systems and medical equipment. Violations occurred in situations when the correct procedure or protocol was known to the juniors but compliance would have introduced a time-delay or the necessary equipment was not readily available. Examples of each of the types of error that could be classified according to the original version of GEMS are shown in Figure 19.

Figure 19 - Examples of skill-based skills and lapses (1, 2 and 3), rule-based mistakes (4, 5 and 6), knowledge-based mistakes (7, 8 and 9) and violations (10, 11 and 12)

	Description of error *(scenario number in parentheses)*	**Evidence from scenario (S) or debrief (D)**
Skill-based slips and lapses		
1	Tells senior colleague on the phone that the patient's heart rate is 98 beats per minute (10)	Monitor shows that the heart rate is 130 beats per minute and the oxygen saturation is 98%
2	Fails to order chest x-ray for patient in respiratory distress, despite volunteering to do so (5)	Junior (S): "*We need a chest x-ray.*" Reply from other junior: "*You call for help and I'll do that.*" (unable to do so as colleague uses the phone and never returns to the task)
3	Patient's notes not checked for current medications as possible cause of hypoglycaemic coma (7)	Junior (D): "*I completely forgot about the kardex* [drug chart], *that's when I was going to read that he was diabetic, and then the phone went*" [referring to his plan to review the drug chart]
Rule-based mistakes		
4	Treats patient with partial airway obstruction secondary to hypoglycaemic coma with nebulised salbutamol, requiring oxygen to be reduced (7)	Junior (D): "*He wasn't wheezy, I know. I listened to his chest*" Tutor: "*Why did you think it was asthma?*" Junior: "*Because there was noisy breathing and a fast respiratory rate*"
5	Patient in septic shock with no evidence of cardiac dysfunction treated with 500mls of saline over one hour (3)	Junior (S): "*I don't want to put him into heart failure, let's put it over an hour.*" [discussing intravenous fluid prescription with nurse]
6	Juniors aware that senior help is not arriving for 20 minutes and patient having a major post-operative bleed (17)	Tutor (D): "*Did 2222* [emergency call] *cross your mind?*" Junior: "*Yes it did at one point.*" Tutor: "*Why didn't you call it?*" Junior: "*I felt like the patient's consciousness wasn't impaired.*"
Knowledge-based mistakes		
7	Recognition of partial airway obstruction but no simple manoeuvres attempted and no advice sought (7)	Junior (S): "*He's sounding very obstructed; he's got an obstructed airway.*" Reply from other junior: "*We can't do anything about it, can we?*"

8	Recognition of severe sepsis but no attempts made to give antibiotics (18)	Tutor (D):"*Did the patient get antibiotics?*" Junior: "*No, because I didn't know how to administer them*"
9	Patient with major post-operative bleeding is causing concern but no attempt made to obtain senior help (17)	Junior (D): "*I was thinking about maybe calling the anaesthetist. I was thinking: I need an anaesthetist, where do I get one of those?* '"
Violations		
10	Feels patient's pulse but does not count rate or ask for any monitoring (11)	Junior (S): "*He's got a pulse as well; I can't tell the rate, I don't have a watch.*"
11	Junior has just checked first unit of blood correctly. Nurse passes second unit of blood to junior and asks for it to be checked. Junior looks at the patient's notes for several seconds and then passes blood back to nurse, stating it has been checked when it has not (12)	Junior (S): "*Yes, that's checked as well.*"
12	Sends cross-match sample to blood bank despite being unsure of whether the details on the tube and corresponding form have been completed correctly (14)	Porter (S): "*Is it labelled properly this time?*" Reply from junior: "*I'm not sure.*"

5.4.3 Proposed modifications

5.4.3.1 Compound error

Some errors occurred solely because of a preceding error and have thus been termed compound errors. This category includes errors stemming from the misunderstandings of others, as well as from a junior's own misperception or misinterpretation of information. Two examples of compound errors are shown in Figure 20.

5.4.3.2 Submission error

At times there was disagreement between the junior doctor participants as to the most appropriate course of action. The data revealed a second error type which has not been previously described in association with GEMS: submission error. Such an error occurred when a junior doctor was dissuaded from taking the most appropriate course of action by another participant advocating less appropriate measures. This

type of error is clearly only applicable in situations where multiple individuals are working towards a common goal. Two examples of submission errors are shown in Figure 20.

Figure 20 - Examples of compound errors (1 and 2) and submission errors (3 and 4)

	Description of error *(scenario number in parentheses)*	**Evidence from scenario (S) or debrief (D)**
Compound errors		
1	Junior uses observation chart as a surrogate for current physiology and then provides insufficient oxygen to patient (9)	Junior (D): "*We had the patient on a Hudson* [variable performance] *mask... 97% sats* [oxygen saturation] *so I didn't think we needed to jump in with all guns blazing.*"
2	Junior tells senior colleague on the phone that a 12 lead ECG has been performed when it has not, it had merely been mentioned to the nurse (5)	Junior (D): "*When she was asking me what tests we had done and for information on what we'd done, you know, we seemed to have covered all the bases.*"
Submission errors		
3	One junior is very keen to call for senior help but dissuaded from doing so by other junior who insists on the requirement for investigation results prior to calling (9)	Junior (S): "*Should we get an SHO* [more senior doctor] *here?*" Reply from other junior: "*I suppose we need to send the bloods first, and get an ECG* [electrocardiogram]."
4	Aware patient is bleeding; one junior keen to use blood as primary resuscitation fluid but persuaded by other junior not to request any blood from blood bank (2)	Junior (S): "*I think we should just give more fluid.*" Reply from other junior: "*But if she's bleeding blood then we should give her blood.*" Junior: "*...can we not just keep giving her saline, or jelly* [colloid] *or something?*"

5.5 Discussion

All 38 junior doctors who were invited to participate in the study agreed to take part. Such enthusiasm contrasts sharply with the low response rate to the questionnaire study described in chapter 2. It is likely that the educational value of the simulated scenarios was evident to the newly qualified doctors who were approached. Data collection for the study formed an optional component of the three-day induction programme at the Western General Hospital, and it is probable that a desire to rehearse emergency scenarios was fuelled by the anxiety of commencing work.

This chapter has demonstrated that Reason's GEMS provides a valid framework for categorisation of the errors made by junior doctors in simulated acute care contexts. Examples of skill-based slips and lapses, RBMs, KBMS and violations could be clearly identified in the data from the video-recorded scenarios and audio-recorded debriefs. Two new types of error are proposed: compound errors and submission errors. In their work on junior doctors' prescribing errors, Dornan *et al.* modified GEMS by the addition of a category called 'communication error' (Dornan et al., 2009). This additional category was used to describe prescription errors resulting from the receipt of erroneous information from patients or other healthcare professionals. In this work, all errors were attributed to the team of doctors, rather than a single participant, except when evidence existed for the same error having been made by more than one participant for different reasons. Dornan *et al.*'s 'communication errors' are therefore a subset of the wider group of compound errors discussed above.

When a junior doctor commits an error due to incorrect information provided by another healthcare professional, Dornan *et al.* noted the inevitable consequence of the junior becoming mistrusting of information given to them by other members of the team (Dornan et al., 2009). The data presented in this chapter demonstrate a second type of compound error stemming from the misperception or misinterpretation of information by oneself. The fallibility of human perception and memory systems are well-documented in the cognitive psychology literature (Dror, 2005), but such concepts have been much slower to penetrate medical education

research and curricula design. Elevated stress levels have been shown to impede performance in a multitude of cognitive processes required in acute care contexts including those that involve divided attention, working memory, retrieval of information from memory, and decision making (LeBlanc, 2009). Recent calls for training in error recovery (Dror, 2011), as complementary to more popular error reduction strategies (Brannick et al., 2009), may hold the key to developing junior doctors' abilities to recognise error in both their colleagues and themselves. Rather than mistrusting their professional colleagues, an awareness of how affect and emotion can impact on behaviour may promote patient safety by prompting junior doctors to be less trusting of their own cognition in stressful, high-stakes situations.

Submission errors are restricted to situations in which team-working is required. All participants had the same level of education and comparable clinical experience. It has to be assumed, therefore, that participant willingness to deviate from their first choice strategy reflected a lack of confidence, either in their clinical decision-making or in their ability to convince others of the correct course of action. There were times, however, when junior doctors were diverted away from an inappropriate course of action and 'saved' from poor decisions by the decisiveness of their colleagues. It would therefore be unwise to advocate obstinacy on the part of junior doctors, but instead encourage distributed situation awareness and shared decision making. As discussed in chapter 4, in contrast to the conventional model of situation awareness:

> "the perception of elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future" (Endsley, 1995),

distributed approaches to situation awareness recognise the dynamic interactions between the junior doctors, other healthcare professionals and the patient (Fioratou et al., 2010). The sharing of information, ideas and projections was conspicuously absent from the scenarios in which an appropriate course of action was traded for a less appropriate one. Within the rigid hierarchy of hospital medicine, one might reasonably assume that the junior doctors involved in this work may be even less

willing to highlight the perceived errors of their senior colleagues than they were to challenge their peers in the 'safe' environment of simulation.

5.5.1 Limitations

The work detailed in this chapter used the observation of high-fidelity simulated practice of junior doctors trained at various institutions to inform and amplify an existing error framework. However, it is probable that not all of the errors made in each scenario were elicited, and the identification of error was likely to have been influenced by VRT's own experiences and interests. Many of the errors observed could not be attributed to a single cause due to insufficient evidence from either the scenario or debrief recording. This may reflect a lack of debriefing time, participant reluctance to discuss particular errors or the complexity of decision-making in acute care contexts.

It is possible that, in the artificial environment of the simulator, the junior doctors behaved in ways that did not reflect their behaviour in everyday clinical practice, particularly in relation to violations. The risk of such discrepancy was minimised by the use of high fidelity simulation and the absence of senior clinicians within the scenarios. Discussions between juniors during scenarios focused on their actions rather than omissions, and as such, errors of omission were more difficult to identify and subsequently classify. Consequently, scenarios containing long periods of inactivity presented relatively few opportunities for error classification. As with all forms of interview, the collection and analysis of data will have been influenced by the social context of the discussion (Reeves et al., 2006). The team's attempts to create a relaxed debriefing environment were unlikely to have negated the inhibitory effect of senior clinician presence. The junior doctors may have chosen to amend the explanations of their actions to concord with the perceived agenda of the facilitator.

5.5.2 Conclusion

In advance of the work detailed in chapter 6, this chapter demonstrates that GEMS may help to illuminate acute care error from a new perspective and suggests that the emphasis on diagnostic error within contemporary medical education discourse gives an incomplete picture when applied to acute care error. GEMS provides a pragmatic

framework that incorporates, but is not restricted to, diagnostic error. The work in this chapter has adapted GEMS for use in acute care, and this amplified framework may be transferable to other situations involving close team-working in small groups. Compound errors and submission errors almost certainly occur in other medical and non-medical contexts, and future work could focus on evaluating the extent to which the amplified framework is transferable to other fields. In terms of specific error types, it would be particularly interesting to explore the contributions of factors such as personality type and self-confidence to the occurrence of submission errors. The amplified version of GEMS will be used in chapter 6 to identify the knowledge and skills that are most vulnerable to specific error types.

Chapter 6: Exploring patterns of error in team-based acute care

6.1 Introduction

Chapter 5 concluded that the amplified version of GEMS provides a valid framework for categorisation of the errors made by junior doctors in simulated acute care contexts. In order to identify patterns within the data, this chapter cross-references the acute care knowledge, skills and behaviours identified as most vulnerable to error with the corresponding GEMS categorisation. Improved understanding of such patterns of error may offer a range of benefits to both junior doctors and patients. At the most basic level, simply discussing the propensity for specific errors with junior doctors may be sufficient to change behaviour. Furthermore, the identification of specific patterns of error may facilitate the development of tailored educational strategies. It seems likely, for example, that the reduction of knowledge-based mistakes necessitates different educational techniques to the reduction of skill-based slips and lapses. It is hoped that the patterns of error identified can be used to guide a range of strategies which will both ease the transition to professional practice and enhance patient safety.

Taxonomies of knowledge, skills and behaviours relevant to the assessment and management of acutely unwell patients have been developed and utilised in previous studies. There are clear benefits to the application of a pre-existing, validated framework. However, such frameworks may also restrict the scope of a study or fail to represent the richness of a new dataset. Pre-existing frameworks that share some of the facets of knowledge, skills or behaviours that appear to be relevant to junior doctors in acute care contexts may be sub-divided into three main groups: behavioural marking systems, scenario checklists and resuscitation competencies.

Perhaps most relevant group are the so-called 'behavioural marking systems' which were originally developed for research and training within the aviation industry (Klampfer et al., 2001). Behavioural markers are defined as "observable, non-technical behaviours that contribute to superior or substandard performance within a work environment" (Klampfer et al., 2001). Some systems, such as The Oxford

Non-Technical Skills (NOTECHS) scale, originally produced to rate European pilots' teamwork skills on the flight deck, have been adapted for use in healthcare (in the case of NOTECHS for operating-theatre teamwork quality (Mishra et al., 2009)). Other marking systems incorporate observation of a variety of skills which, along with their associated behavioural markers, are sub-divided according to the research-derived categories relevant to a particular context and professional group. To date, three multi-faceted healthcare-related behavioural marking systems have been developed and validated for use in the UK: Anaesthetists' Non-Technical Skills (ANTS) (Fletcher et al., 2004, Flin and Maran, 2004), Non-Technical Skills for Surgeons (NOTSS) (Yule et al., 2006) and Scrub Practitioners' List of Intra-operative Non-Technical Skills (SPLINTS) (Mitchell et al., 2012). As might be expected, there is a great deal of overlap between the main categories of non-technical skills identified in each of these three systems, with situation awareness, task management, teamwork, communication, decision-making and leadership appearing in various combinations. The limitations of such systems in relation to this work are twofold. Firstly, all three pre-existing behavioural marking systems have been developed and validated for use within a theatre environment. The challenges of working in such contexts (such as multiple teams of practitioners, anaesthetised patients and complex monitoring equipment) clearly differ substantially from the challenges faced when dealing with a life-threatening situation in a general ward (such as fewer staff, potentially alert patients and limited equipment). Furthermore, whilst it is acknowledged that the care of acutely unwell patients could almost certainly be improved by focusing on the non-technical aspects of care provision, previous studies (Smith and Poplett, 2002, Smith et al., 2007), along with the work detailed in chapters 2 and 4, indicate that there are deficits relating to knowledge-base and technical skills which would be helpful to identify.

The second group of pre-existing frameworks with some relevance to this work are derived from studies which have developed lists of behaviours (often specific clinical tasks) relevant to an individual clinical scenario. Some scenarios, such as the provision of a general anaesthetic for emergency Caesarean section (Scavone et al., 2006), clearly share some of the challenges presented by ward-based acute care

scenarios. However, the 52-item task list is too context-specific to apply to other clinical situations. In terms of scenarios developed for the assessment of acute care skills in medical students or junior doctors, Murray *et al.*'s 18 point checklist is specific to haemorrhagic hypotension secondary to a long bone fracture (Murray et al., 2002) and Paskin's *et al.*'s checklists are specific to acute coronary syndrome and severe asthma (Paskins et al., 2010). Several acute care assessment checklists include aspects of timed assessment (such as time taken to assess airway, breathing and circulation) (Boulet et al., 2003, Donoghue et al., 2010, Paskins et al., 2010). As these numerical values primarily reveal the consequences and not the causes of error, the collection of such data was not necessary or appropriate to fulfil the primary aim of this work.

The third group of frameworks which may be considered directly applicable to acute care contexts are those provided by structured resuscitation courses. The lists of core competencies addressed by the Advanced Life Support course, the Immediate Life Support course and the Acute Care Undergraduate Teaching (ACUTE) initiative are readily available from the Resuscitation Council (UK) (Perkins et al., 2005). These lists have been developed in a variety of ways; for example, the ACUTE core competencies were identified using a modified Delphi technique, whereby 2629 suggestions were reduced to 88 representative themes in 12 domains (Perkins et al., 2005). Whilst the list undoubtedly provides a helpful template for undergraduate training in acute care, it was unsuitable for this study due to its granular detail and focus on technical skills. The results described in chapter 2 indicate that whilst technical skills are a source of concern for both junior doctors and their educational supervisors, non-technical skills such as decision-making, initiative and prioritisation were also felt to be important. The search for a framework which was transferable between various acute care scenarios and which facilitated the categorisation of both technical and non-technical skills yielded no suitable results. The inductive development of such a framework therefore forms the initial aim of this chapter.

6.2 Chapter aims

This chapter aims to answer the following questions:

1. What are the main subject areas in which specific knowledge, skills and behaviours are required by junior doctors to assess and manage acutely unwell patients?
2. How do the errors made in each subject area relate to the types of error as classified by the amplified GEMS framework?

6.3 Methods

6.3.1 Design and initial analysis

The work in this chapter uses the data obtained from the simulated acute care scenarios described in chapter 5. Initial analysis was undertaken as described in the previous chapter; this chapter focuses on the subsequent layer of analysis. Given the lack of a suitable pre-existing framework, the first research question was addressed by using the principles of 'Framework' to inductively develop a thematic framework consisting of key subject areas (Ritchie and Spencer, 1994). Such subject areas represent the facets in which, on the basis of the data analysed, junior doctors are required to demonstrate the appropriate knowledge, skills or behaviours (or any combination of those three aspects) to appropriately assess and manage acutely unwell patients. By virtue of the type of data collected, all key subject areas relate to facets of observable behaviour and do not include attitudes or personality traits which can only ever be inferred and never directly observed.

6.3.2 Development of the framework

Originally developed within the field of applied social policy research, 'Framework' is an analytical process which facilitates systematic analysis of qualitative data whilst promoting the generation of "actionable outcomes" (Ritchie and Spencer, 1994). During the preliminary stage of this work, VRT and SES noted the types of errors observed. Using a combination of these notes and the intention-related evidence derived from either the video-recorded scenario or audio-recorded debrief, VRT and SES inductively developed a preliminary thematic framework. As expected, the first version of the framework drew heavily on previous related work (Tallentire et al.,

2011a) and other "a priori issues" (Ritchie and Spencer, 1994). VRT and SES then independently applied the early version of the framework to the datasets constructed from the first four scenarios and corresponding debriefs, and allowed the developing framework to be influenced by emergent issues and analytical themes arising from the recurrence of particular error types. VRT and SES then discussed their independent analyses and compared, contrasted and negotiated categories until agreement on a final indexing system was reached.

Once finalised, the thematic framework was systematically applied to the entire dataset of junior doctor errors. Working together, VRT and SES discussed the error descriptions from the video-recorded scenarios in conjunction with the additional evidence derived from the scenarios (body language, direct quotes and other verbal clues) and debriefs (including direct quotes and other paralinguistic clues such as laughter), until agreement on categorisation was reached. The use of Excel (Microsoft Office 2007) for the indexing of errors facilitated inter-scenario and intra-scenario comparison of errors so that patterns within the dataset as a whole, as well as connections between specific error types within an individual scenario, could be identified and explored. Accordingly, this chapter focuses on a thematic analysis across all errors and thus 'charts' (Ritchie and Spencer, 1994) for each key subject area were developed.

6.3.3 Pattern identification

In order to address the second research question, a multidimensional analysis involving both the amplified GEMS classifications described in chapter 5 and the inductively-developed subject areas from the subsequent analysis was undertaken. In keeping with the principles of Framework, a distilled summary of each error was entered into the chart to promote abstraction and synthesis (Ritchie and Spencer, 1994). Throughout the analysis, each error remained referenced with a specific numerical code so that the source scenario could be traced and contextual validity continually checked. The errors within an individual subject area were then compared and contrasted, and patterns within the data were sought, in both a descriptive and numerical sense.

6.4 Results

The eight key subject areas that formed the final version of the thematic framework are defined in Figure 21. The number of errors relating to each subject area, sub-classified using the version of GEMS amplified for use in team-based acute care contexts, is displayed in Figure 22. The purpose of Figure 22 is to allow comparison of the different error types *within*, as opposed to *between*, the various subject areas. It is the patterns within the data, as opposed to the actual numerical values, that are of interest. Figure 23 shows specific examples of errors relating to each of the eight key subject areas. The errors relating to each subject area and the patterns emerging from Figure 22 are explored in detail below.

Figure 21 - Descriptions of the eight key subject areas used for framework analysis

Key subject area	Description as used within this study
Hospital systems	Errors stemming from the inappropriate use of, or misunderstanding of, generic UK hospital systems, procedures or protocols. This includes the provision of senior assistance only where UK-wide policies exist (such as the generic 2222 emergency call).
Infection control	Errors which related to widely-accepted minimum infection control practices in ward-based settings (such as wearing gloves to insert an intravenous cannula).
Prioritisation	Errors which relate to the incorrect ordering of two or more tasks when judged in relation to current UK resuscitation guidelines or, when guidelines unavailable, potential to impact patient outcome.
Procedural skill	Errors occurring during the undertaking of finite, schema-driven tasks in which all UK graduates are expected to be competent (such as venepuncture).
Situation awareness	Errors arising from either a lack of awareness of the elements of the scenario indicating severity, or a failure to assimilate such information in a way which informs decision-making.
Treatment	Errors of either commission or omission in choice of therapeutic intervention in relation to UK current resuscitation guidelines. Omissions were only identified when a single best treatment is unequivocal (such as blood transfusion in haemorrhagic shock).
Communication	Errors arising directly from either giving inappropriate, insufficient or erroneous information to colleagues, or from mishearing or misinterpreting information provided by others. This includes both written information (such as contained within the patient's notes) and verbal information (such as during phone calls with senior doctors).
Ethical principles in practice	Errors resulting from the inappropriate application of ethical principles within an emergency scenario, when patients lack capacity to make informed decisions and prioritisation of such principles will be detrimental to patient outcome.

Figure 22 - A multidimensional analysis of errors categorised according to the amplified version of GEMS and the inductively-developed key subject areas

Key subject area	Amplified version of Reason's generic error modelling system (GEMS)						Intention not established	TOTALS
	Skill-based slips / lapses	Rule-based mistakes	Knowledge-based mistakes	Violations	Compound errors	Submission errors		
Hospital systems	1	**24**	13	3	0	0	11	52
Infection control	1	0	0	0	0	0	**18**	19
Prioritisation	1	**10**	0	3	0	2	6	22
Procedural skills	**18**	0	**12**	0	1	0	3	34
Situation awareness	**20**	9	8	1	**19**	1	11	69
Treatment	2	**12**	6	0	0	1	2	23
Communication	**11**	0	1	1	1	1	2	17
Ethical principles in practice	0	**6**	0	1	0	0	0	7
TOTALS	54	61	40	9	21	5	53	243

The shaded boxes indicate patterns within the dataset that will form the basis of subsequent discussion.

Figure 23 - Specific examples of errors relating to seven of the key subject areas

	Description of error (*scenario number in parentheses*)	**Evidence from scenario (S) or debrief (D)**	**GEMS classification**
Hospital systems			
1	Surgeon paged (but had not answered) and junior doctors assumed that the surgeon was therefore on his/her way to the ward (2)	Junior (S): "*He's been called so he's on his way.*"	Rule-based mistake
2	Patient with major post-operative bleeding is causing concern but no attempt made to obtain senior help (17)	Junior (D): "*I was thinking about maybe calling the anaesthetist. I was thinking: I need an anaesthetist, where do I get one of those?* '"	Knowledge-based mistake
3	Sends cross-match sample to blood bank despite being unsure of whether the details on the tube and corresponding form have been completed correctly (14)	Porter (S): "*Is it labelled properly this time?*" Reply from junior: "*I'm not sure.*"	Violation
Prioritisation			
4	Specific investigation (electrocardiogram [ECG]) is arranged before any assessment of the patient has been undertaken (3)	Junior (S): "*What we need to do first is another trace of the heart.*"	Rule-based mistake
5	Feels patient's pulse but does not count rate or ask for any monitoring (11)	Junior (S): "*He's got a pulse as well; I can't tell the rate, I don't have a watch.*"	Violation
6	One junior doctor is very keen to call for senior help but dissuaded from doing so by other	Junior (S): "*Should we get an SHO* [more senior doctor] *here?*" Reply from other junior: "*I suppose*	Submission error

	junior who insists on the requirement for investigation results prior to calling (9)	*we need to send the bloods first, and get an ECG* [electrocardiogram]."	
Procedural skills			
7	Nurse corrects lead placement of junior doctor for ECG monitor (6)	Nurse (S): "*The red one goes on the other side.*" Junior: "*Oops, so it does.*"	Skill-based slip/ lapse
8	Recognition of severe sepsis but no attempts made to give antibiotics (18)	Tutor (D):"*Did the patient get antibiotics?*" Junior: "*No, because I didn't know how to administer them*"	Knowledge-based mistake
Situation awareness			
9	Junior doctor suggested checking the volume of blood in the patient's drains, but the task was never undertaken (12)	Junior (D): "*I remember you saying 'have you checked the drains?' because we hadn't.*" Other junior doctor: "*but then I didn't actually myself look at the drains when I should have, I thought you had, yeah, I thought...*"	Skill-based slip / lapse
10	Junior doctor uses observation chart as a surrogate for current physiology and then provides insufficient oxygen to patient (9)	Junior (D): "*We had the patient on a Hudson* [variable performance oxygen mask] *mask... 97% sats* [oxygen saturation] *so I didn't think we needed to jump in with all guns blazing.*"	Compound error
11	Junior doctor tells senior colleague on the phone that a 12 lead ECG has been performed when it has not, it had merely been mentioned to the nurse (5)	Junior (D): "*When she was asking me what tests we had done and for information on what we'd done, you know, we seemed to have covered all the bases.*"	Compound error

Treatment			
12	Patient in septic shock with no evidence of cardiac dysfunction treated with 500mls of saline over one hour (3)	Junior (S): "*I don't want to put him into heart failure, let's put it over an hour.*" [discussing intravenous fluid prescription with nurse]	Rule-based mistake
13	Recognition of partial airway obstruction but no simple manoeuvres attempted and no advice sought (7)	Junior (S): "*He's sounding very obstructed; he's got an obstructed airway.*" Reply from other junior: "*We can't do anything about it, can we?*"	Knowledge-based mistake
Communication			
14	During phone call, surgical registrar [more senior doctor] is dismissive of junior doctor, who is told to 'just carry on' but left with the false impression that the senior doctor was coming to help (5)	Junior (D): "*I felt better because they* [the surgical registrar] *were coming to see the patient.....if I had been completely useless in my handover then they probably would have just said for me to do all these tests and then ring back when I'd done.*"	Skill-based slip/ lapse
Ethical principles in practice			
15	Junior doctors persuaded by hypoxic, confused, exsanguinating patient to remove the oxygen mask (9)	Junior (D): "*I didn't know how much you can make someone do something who is, you know, confused. But then he's sick. That was hard.*"	Rule-based mistake

6.4.1 Key subject areas

6.4.1.1 Hospital systems

Specific examples of errors relating to hospital systems are shown as numbers 1, 2 and 3 in Figure 23. Within this subject area there was a predominance of rule-based mistakes. Many such errors related to attempts to obtain senior assistance and demonstrated a range of misunderstandings, from the function of paging systems (see example 1, Figure 23) to the roles of anaesthetists. As well as *how* to call for help, rule-based mistakes also related to *who* to call. Examples of the misapplication of good rules included calling the diabetic registrar for immediate resuscitation advice in relation to a patient with hypoglycaemic coma and airway compromise, and phoning a laboratory technician for advice regarding antibiotic choices in septic shock. A similarly large number of rule-based mistakes related to transfusion procedures and protocols, particularly the completion and checking of patient-identifiable information with the notes at the bed space in preference to the patient's wristband.

6.4.1.2 Infection control

Errors relating to infection control practices most commonly included the absence of plastic gloves for intravenous cannula insertion or surgical wound examination. Such errors were rarely explored during debriefing and, as such, there was usually insufficient evidence to confidently attribute the error to one of a number of possible explanations, including simulator artefact.

6.4.1.3 Prioritisation

Specific examples of errors relating to prioritisation are shown as numbers 4, 5 and 6 in Figure 23. The most common errors in this category were rule-based mistakes involving junior doctors deciding to undertake investigations such as an electrocardiogram or arterial blood gas before performing an assessment of the patient's airway patency or vital signs (see example 4, Figure 23). Such investigations may be crucial in guiding subsequent management, but should never take precedence over a basic clinical assessment or the provision of urgent senior assistance when the clinical situation is life-threatening (see example 6, Figure 23).

6.4.1.4 Procedural skills

Errors 7 and 8 in Figure 23 are examples of errors relating to the key subject area of procedural skills. As shown in Figure 22, the majority of errors relating to procedural skills were skill-based slips or lapses, commonly involving failure to remove the tourniquet from the patient's arm following intravenous cannula insertion. Knowledge-based mistakes were also relatively frequent, with juniors having to ask the nurse helper to assist with various tasks that they did not know how to perform. Such tasks included the transfer of blood from a syringe into culture bottles, instigating three-lead electrocardiogram monitoring, 'spiking' a bag of fluid with a giving set and 'running through' a giving set prior to intravenous fluid administration.

6.4.1.5 Situation awareness

Errors 9, 10 and 11 in Figure 23 are specific examples of errors that relate to the more nebulous concept of situation awareness, defined for the purpose of this chapter in Figure 21. A large proportion of the errors relating to situation awareness were skill-based slips or lapses. The junior doctors were frequently interrupted during their initial clinical examination, either by their colleagues, the patient or telephone calls, and consequently often missed essential pieces of information which would have guided their illness-severity judgement (see example 9, Figure 23). There were a large number of compound errors (errors occurring solely because of a preceding error, described in full in chapter 5) relating to situation awareness. Such errors stemmed from the misunderstandings of others, as well as from a junior's own misperception or misinterpretation of information. The preceding, causative error was most commonly a rule-based mistake (see example 10, Figure 23), but compound errors also followed knowledge-based mistakes and skill-based slips and lapses.

6.4.1.6 Treatment

Rule-based mistakes in relation to treatment choices were common and most frequently related to type or flow rate of intravenous fluid resuscitation (see example 12, Figure 23). In contrast, knowledge-based mistakes more commonly related to airway maintenance (see example 13, Figure 23) and antibiotic choice.

6.4.1.7 Communication

The majority of errors relating to communication were skill-based slips and lapses. Such errors commonly involved mishearing or misinterpreting verbal information provided by the nurse helper in response to direct questions asked by the juniors, or misinterpreting what was said in a telephone conversation (see example 14, Figure 23). Other communication errors involved the relay of inaccurate information to senior colleagues or inappropriate information to switchboard operators. However, errors were not confined to the *content* of information relayed within a telephone call, but also related to the level of *urgency* conveyed; on several occasions juniors who had stated within the scenario that they required senior clinician presence asked only for "some advice" on the telephone. Misinterpretation of written information occurred less frequently, but there were incidents of junior doctors misreading patient notes, drug charts and local clinical guidelines.

6.4.1.8 Ethical principles in practice

This eclectic mix of errors consisted largely of rule-based mistakes. The most common type of error occurred in situations in which the capacity of the patient to refuse life-saving treatment was, due to critical illness, likely to be highly questionable. On some occasions, confused or semi-conscious patients had life-saving treatment denied or even removed (see example 15, Figure 23) as a result of the junior's overarching concern for patient autonomy.

6.4.2 Error patterns

Figure 24 - A diagrammatic representation of the main patterns emerging from the multidimensional analysis showing the predominance of specific error types occurring in relation to each key subject area

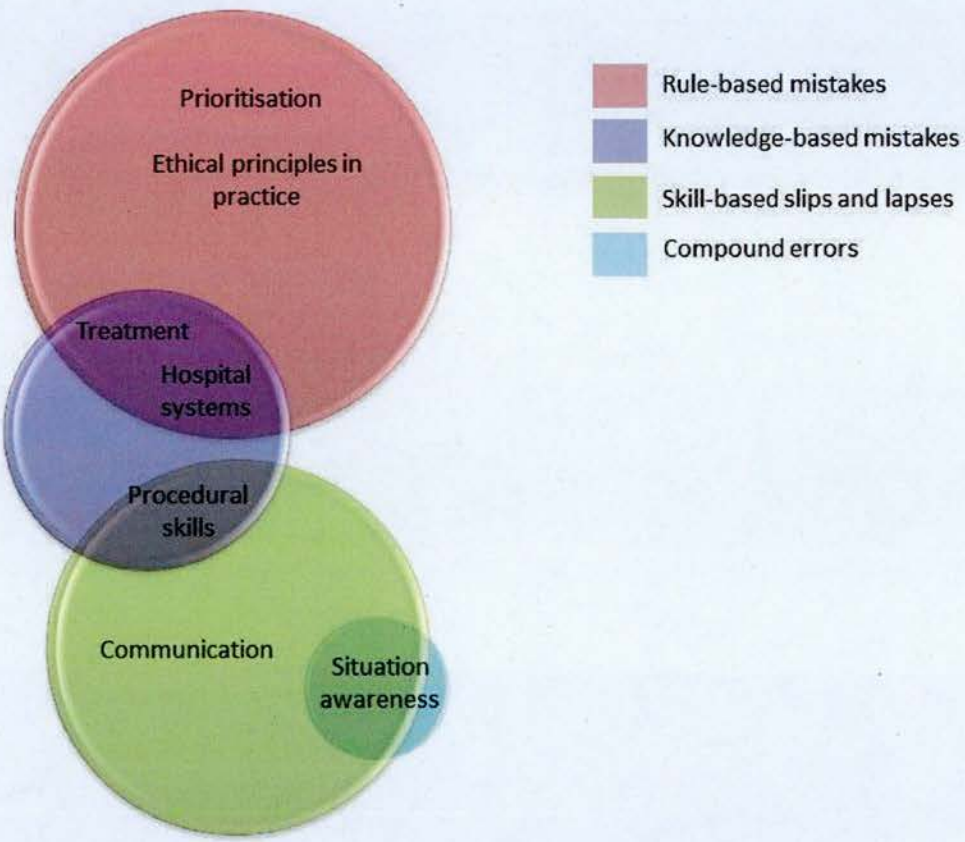


Figure 24 is a diagrammatic representation of the main patterns emerging from the multidimensional analysis. The diameters of the circles are proportional to the number of errors that could be classified as each error type using the amplified version of GEMS. The positions of the key subject areas in the diagram indicate the predominance of a particular error type or types in relation to a particular subject area. The Figure begins to indicate where educational strategies might be most effectively targeted. It becomes more obvious that rule-based mistakes and skill-based slips and lapses were identified most frequently. It is notable that knowledge-based mistakes only predominate alongside other error types within an individual subject area, indicating that there is no particular subject area within acute care in which junior doctors consistently lack knowledge.

6.5 Discussion

This chapter has built on the work described in chapter 5 by using the amplified version of GEMS to identify the knowledge, skills and behaviours required in acute care scenarios that are most vulnerable to specific error types. The specific patterns emerging from the data can be used to guide educational strategies pertinent to both undergraduate and postgraduate training, as discussed in chapter 7.

The major methodological issue arising from this chapter is the use of numbers in qualitative research. Most qualitative researchers who reject the use of numerical data articulate their objections with reference to the philosophical underpinning of their work. As Maxwell states,

> "Primarily, this is because they have believed that numerical data are incompatible with a constructivist stance for research, as such data imply the existence of a single "objective" reality that can be measured and statistically analysed to reach generalizable conclusions" (Maxwell, 2010).

However, several prominent qualitative researchers have supported the inclusion of numbers in qualitative research practices and reports for many years (Becker, 1970, Hammersley, 1992), and medical education journals are beginning to embrace the concept (Rees and Monrouxe, 2011). Despite this, it remains controversial and is particularly opposed by qualitative researchers who have previously had to contend with the quantitative researchers' view that numbers provide credibility. As a basis for the work presented in this chapter, VRT believes that the use of numbers alone does not define the difference between constructivist and positivist research paradigms. It is, perhaps, more helpful to adopt Maxwell's distinction of "thinking of the world in terms of variables and correlations and in terms of events and processes" (Maxwell, 2010). This distinction is relevant to, although certainly not equivalent to, the use of numbers. Within this chapter, the incorporation of numerical data helps to reveal patterns, provide precision and promote clarity. They have, however, been used only in ways that recognise their limitations, preserve the richness of the dataset and do justice to the complexity of the phenomena being studied.

Figures 22 and 24 show the patterns emerging from the 243 errors observed. They suggest that educational strategies should focus on rule application and minimising skill-based skills and lapses. The former challenge seems amenable to simulation training, where students can experiment with changing priorities, whilst observing and subsequently discussing the clinical consequences. Many of the rule-based mistakes indicated that the junior doctors possessed sufficient knowledge, but were unable to identify the specific clinical scenario in which to put such knowledge into practice. This resonates with the findings discussed in chapter 4 which revealed that juniors felt that translating theoretical knowledge into practice, particularly in relation to applying a structured approach to patient assessment, presented a challenge.

It is likely that stress affects the prevalence of skill-based slips and lapses. The fallibility of human cognition has been discussed previously in chapter 4. The findings described within this chapter, in particular the predominance of skill-based slips and lapses related to basic procedural skills and situation awareness, again demonstrate both the detrimental effects of stress on cognition (LeBlanc, 2009) and the tendency for attention to become so focussed on one aspect of a situation that other important cues go unnoticed (Flin et al., 2008). In order to reduce errors in acute care contexts, it is therefore important to provide training which acknowledges the role of stress and provides strategies to reduce its impact.

6.5.1 Limitations

The work detailed in this chapter uses high-fidelity simulation to explore the patterns of error committed by junior doctors trained at various institutions. Observation through video is an under-utilised research method (Rees, 2010) which has the advantage of capturing linguistic, paralinguistic and non-verbal communication. The inductive development of a novel framework has the advantage of maintaining the richness of the dataset, and the use of Framework analysis has facilitated the generation of actionable outcomes.

However, the work contained within this chapter has several limitations, some of which echo those described in chapter 5. Particular difficulties were associated with

identifying all errors, and the identification process was undoubtedly influenced by the ideas, beliefs and clinical experience of VRT and SES. Furthermore, the lack of sufficient evidence to attribute many of the errors to a single cause necessitated their exclusion from the multidimensional analysis. A major limitation of all studies employing simulation is that behaviour in the simulated environment may not mimic behaviour in everyday clinical practice. In the context of this work, this seems particularly likely in relation to certain key subject areas, such as infection control, where the absence of a real sense of infection risk, to either the patient or the junior doctor, may have influenced the decision to wear gloves. Such limitations were minimised by the use of high-fidelity simulation involving fake blood and genuine wound dressings and cannulation equipment, but could not be entirely eliminated. It is interesting to consider whether tutor suspicion of 'simulator artefact' was the reason that few infection control errors were explored during debriefing. A lack of evidence pertaining to intention means that the error pattern with this key subject area (and, to a lesser extent, in relation to prioritisation) has not been established using this method.

The identification of situation awareness errors proved to be particularly challenging. For this chapter, situation awareness was defined as errors arising from either a lack of awareness of the elements of the scenario indicating severity, or a failure to assimilate such information in a way which informs decision-making. This is similar, but not identical, to Endsley's widely-accepted definition:

> "the perception of elements in the environment within a volume of time and space [level 1], the comprehension of their meaning [level 2], and the projection of their status in the near future [level 3]" (Endsley, 1995).

In essence, this work sought errors relating to levels 1 and 2 situation awareness; level 3 errors were difficult to identify as they rarely formed the basis of either scenario-based or debriefing dialogue.

6.5.2 Conclusion

For the initial assessment and management of acutely unwell patients by junior doctors to be improved, it is important that medical educators understand the causes and patterns of common errors. Adequate knowledge alone does not ensure prompt and appropriate management and referral. Errors stemming from misapplied rules, or skill-based slips and lapses appear to be at least as prevalent as those relating to knowledge. Whilst primary medical training programmes in the UK differ substantially, it seems likely that many medical schools do not adequately represent all eight of the key subject areas identified in this work within their core curricula. The teaching of acute care skills may be enhanced by encouraging medical educators to consider both the range of potential error types and their relationships to particular tasks and subjects. Junior doctors are more likely to successfully circumvent common acute care pitfalls if they are made aware of them in training. Future research could focus specifically on one key subject area, and assess the impact of educational interventions designed to reduce error in relation to that particular domain. Chapter 7 builds on the findings of this chapter, along with those presented in previous chapters, to draw conclusions relating to modifications and additions to medical training which may improve the care of acutely unwell patients.

Chapter 7: Final conclusions and implications for practice

7.1 Chapter aim

This thesis has highlighted acute care as an area of activity in which newly qualified doctors feel poorly prepared for practice. It has used a variety of perspectives and frameworks to explore how such doctors perceive and negotiate the complex challenge of assessing and treating acutely unwell patients in the early days of their professional practice. This chapter aims to assimilate the main findings and conclusions by addressing the question:

- What additions or modifications to medical training may improve the care of acutely unwell patients by newly qualified doctors?

This question is addressed using the thematic framework of key subject areas derived in chapter 6, but will also draw explicitly on the findings of chapters 2 to 5. A specific problem statement in relation to each key subject area is followed by a summary of the supporting evidence (from this thesis and previous literature) and recommendations pertaining to educational strategies that may be employed to address the issue.

7.2 Hospital systems

Newly qualified doctors' lack of familiarity with hospital systems can be detrimental to patient care in acute care contexts.

Evidence

In chapter 2, 'familiarity with the ward environment' was identified by both FY1s and their educational supervisors as an important component of the transition to professional practice. The systems-related errors discussed in chapter 6 showed a predominance of rule-based mistakes, particularly in relation to obtaining assistance from senior doctors and transfusion procedures and protocols. Driven by the patient safety movement, some hospital systems (such as the generic '2222' emergency call)

have been adopted nationwide. However, there are still major differences between regions and even between individual hospitals in relation to a huge variety of systems ranging from how senior clinicians are contacted to how specific tests are requested in emergency situations.

Proposed educational strategies

(i) Unlike other aspects of acute care, it is extremely difficult for the nuances and complexities of hospital systems to be replicated in simulated environments. In order to acquire the relevant knowledge, medical students not only need to be present in the workplace for significant periods of time, but should, whenever possible, be actively involved in the delivery of clinical care (Yardley et al., 2012). Tasks such as labelling blood samples, checking blood for transfusion or paging colleagues may be regarded as menial or uninformative by students, yet may be the very systems that they subsequently rely upon to safely assess and treat an acutely unwell patient. The acquisition and application of specific system-related knowledge should be robustly assessed throughout primary medical training, perhaps using workplace-based assessment methods.

(ii) The large number of errors stemming from a lack of familiarity with hospital systems and protocols should be a concern for employers. It is likely that hospital management are unaware of such problems, and induction processes need to be amended to incorporate training in systems and equipment that may be unfamiliar to newly qualified doctors, particularly those who have trained elsewhere. All doctors should be made aware of relevant hospital systems, and the development of simple and workable protocols may be facilitated by the involvement of more junior medical and nursing staff. The GMC mandated student assistantship should ideally provide opportunities for students to familiarise themselves with such systems, but due to the significant variance between hospitals, this initiative will only confer maximal benefit if undertaken in the hospital where they will commence work once qualified.

7.3 Prioritisation

Newly qualified doctors have difficulty prioritising the tasks that are required in acute situations, and are often side-tracked by less important but more easily achievable goals.

Evidence

In chapter 2, prioritisation was identified by Edinburgh graduates and their educational supervisors as an important area influencing preparedness for practice. This echoes previous work concluding that prioritisation is an key component of a junior doctor's role which is usually learned 'on the job', making doctors in their early days feel unprepared (Illing et al., 2008, Lempp et al., 2004). The theme of 'transferring knowledge into practice' in chapter 4 encapsulates the difficulty that newly qualified doctors seem to have in utilising their theoretical knowledge, particularly in relation to applying a structured approach to patient assessment. The predominance of rule-based mistakes relating to prioritisation categorised in chapter 6 resonates with the earlier findings. In life-threatening situations, newly qualified doctors sometimes chose to undertake specific investigations prior to performing a basic clinical assessment or obtaining urgent assistance from senior colleagues. The theme of 'identity and expectations' in chapter 4 reveals that, at least some of the time, such behaviour is motivated by juniors' perceptions of the expectations of their senior colleagues, or their expectations of themselves within their new role.

Proposed educational strategy

(i) In acute care, popular assessment structures (such as ABCDE: airway, breathing, circulation, disability, exposure) and standardised protocols can make prioritisation of tasks easier. However, a high level of familiarity with such structures is required to recall and utilise them in times of acute stress. Primary medical training programmes should facilitate the repeated rehearsal of basic patient assessments, and the transferability of such structures should be emphasised by rehearsal in a variety of contexts. Such learning is amenable to simulation training, whereby students can experiment with changing priorities whilst observing and subsequently discussing the clinical

consequences. However, care must be taken in the planning and execution of such training to replicate the complexities and pressures of the environment in which clinical decisions will ultimately be made. There is much to be learnt from healthcare systems with more advanced simulation training programmes, such as those seen at MSR, the Israel Centre for Medical Simulation. The decontextualised rehearsal of basic assessment structures in simulation training may actually hinder educational development and, if trained in this way, newly qualified doctors are likely to continue to have difficulty utilising such knowledge once they are exposed to the stressful and hierarchical world of clinical practice (Kneebone, 2009, Issenberg et al., 2005).

7.4 Procedural skills

Newly qualified doctors consider themselves to be relatively well prepared in procedural skills, but slips and lapses are commonplace in the stressful context of acute care.

Evidence

The findings in chapter 2 highlight a striking disparity between the preparedness ratings in procedural skills given by FY1s and those afforded by their educational supervisors. Using combined data from three consecutive years, the FY1s placed 'ability to carry out practical procedures' seventh out of 13 domains, but their educational supervisors rated them far less prepared, echoing the results of a previous study (Wall et al., 2006). Chapter 6 details a predominance of skill-based slips and lapses in relation to procedural skills performed during acute care scenarios. It is likely that the prevalence of slips and lapses in relation to procedural skills is, at least in part, influenced by the stressful nature of acute care highlighted in chapter 4. The detrimental effects of stress on cognition have been discussed both within this thesis and elsewhere. Elevated stress levels have been shown to impede performance in a multitude of cognitive processes required in acute care contexts including those that involve divided attention, working memory, retrieval of information from memory, and decision making (LeBlanc, 2009). Furthermore, the data in chapter 6

demonstrate that the undertaking of a procedural skill within an acute care scenario is a typical example of the human tendency for attention to become so focussed on one aspect of a situation that other important cues go unnoticed (Flin et al., 2008, LeBlanc, 2009).

Proposed educational strategies

(i) It is the responsibility of the medical education community to ensure that newly qualified doctors are aware of the interplay between emotion, cognition and behaviour, and the roles of such factors in errors and adverse events. Emotional skills training, particularly with reference to dynamic, high-stakes situations, should form an integral part of primary medical training. Such training should acknowledge the influence of stress and provide strategies to reduce its impact. Furthermore, newly qualified doctors should be provided with opportunities to familiarise themselves with their own responses (both beneficial and detrimental) to acutely stressful situations so that such responses may be explored and amended.

(ii) Educational techniques developed specifically to enhance the performance of basic procedures safely and effectively whilst deploying attention elsewhere, should be incorporated into primary medical training. Based on automaticity theory (Ashby et al., 2007), the gradual additions of distraction or time-pressure to the rehearsal of practical procedures are useful strategies which are beginning to be explored within the field of healthcare education (Smith et al.).

7.5 Situation awareness

In the dynamic and time-pressured context of acute care, newly qualified doctors struggle with assimilating the large volume of available information and utilising it to make illness severity judgements and projections.

Evidence

In addition to errors attributable to incorrect information provided by another healthcare professional described by Dornan *et al.* (Dornan et al., 2009), the more comprehensive type of compound error described in chapter 5 may also arise from the misperception or misinterpretation of information by oneself. A large proportion of the errors relating to situation awareness described in chapter 6 were compound errors (errors occurring solely because of a preceding error). The preceding, causative error was most commonly a rule-based mistake, but compound errors also followed knowledge-based mistakes and skill-based slips and lapses.

The fallibility of human perception and memory systems are well-documented in the cognitive psychology literature (Dror, 2005), but such concepts have been much slower to penetrate medical education research and curricula design. Now that recognition of such concepts is becoming more widespread, there have been calls for medical training to adopt more distributed approaches to situation awareness (Bleakley, 2010). The conventional model of situation awareness is based on the internalised processes of an individual and his/her assimilation of all available information (Gaba et al., 1995). However, a distributed cognition approach to medical decision-making recognises that a junior doctor's decisions do not occur in isolation but are transformed by the dynamic interaction between the junior doctor, the patient, other members of the healthcare team and additional external artefacts (Fioratou et al., 2010). The data presented in chapter 5 detail submission errors, when one doctor was dissuaded from taking the most appropriate course of action by a colleague advocating less appropriate measures. There were times, however, when the opposite situation was observed; a junior doctor was diverted away from an inappropriate course of action by the intervention of his/her colleague. An important finding was that the sharing of information, ideas and projections was conspicuously

absent from the scenarios in which an appropriate course of action was traded for a less appropriate one.

Proposed educational strategies

(i) Good situation awareness, along with adequate knowledge, is recognised as an essential precursor to safe decision-making, particularly in time-pressured and high stakes situations (Flin et al., 2008). Specific training in situation awareness, similar to that provided to all airline pilots, should be a mandatory element of primary medical training. The detrimental effects of stress and fatigue on situation awareness, secondary to a reduction in attention capacity (Flin et al., 2008), should be emphasised. Such training may take the form of simulated scenarios with freeze and reflection, to allow real-time assessment of the trainees' situation awareness. This technique has been shown within police officer training to enhance both situation awareness and shooting performance (Saus et al., 2006).

(ii) Rather than mistrusting their professional colleagues (the consequence noted by Dornan *et al.* following the provision of incorrect information), an awareness of how affect and emotion can impact on behaviour may promote patient safety by prompting junior doctors to be less trusting of their own cognition in stressful, high-stakes situations. Recent calls for training in error recovery (Dror, 2011), as complementary to more popular error reduction strategies (Brannick et al., 2009), may hold the key to developing junior doctors' abilities to recognise error in both their colleagues and themselves. Error recovery training entails specific training in error detection and mitigation, commonly using interactive video or gaming technology (Cherrett et al., 2009). Initially the training may focus on the detection of errors by others, progressing to the detection of one's own errors (Dror, 2011). Recovery countermeasures must then be identified and undertaken in the most appropriate order. Time pressure, distractions and other elements can gradually be added to make the training more demanding and more closely replicate the challenges of acute care.

7.6 Treatment

The misapplication of clinical 'rules' by newly qualified doctors can lead to the provision of inappropriate treatments in acute care contexts.

Evidence

The predominance of rule-based mistakes in relation to treatment decisions detailed in chapter 6 indicates that newly qualified doctors, whilst often possessing adequate clinical knowledge, have difficulty in identifying *when* a particular action or diagnosis is relevant. This finding resonates with the results presented in chapter 4 which reveal that juniors feel that translating theoretical knowledge into practice presents a particular challenge. All professionals, particularly those who are newly qualified, require rules to guide their practice and assist decision-making. However, primary medical training can inadvertently instil 'bad' rules and, without explicit guidance as to their clinical application, 'good' rules can be misapplied with devastating consequences.

Proposed educational strategy

(i) Additions to acute care training should not focus on knowledge acquisition, but instead emphasise *when* a particular action is most appropriate. Opportunities to expose and discuss bad rules, often originating from the hidden curriculum (Hafferty, 1998), should be actively sought in primary medical training. This may be achieved by ensuring that acute care scenarios in both simulated environments and the workplace are followed by discussion of decision-making which focusses on cognition (*why* a decision was made) rather than merely on practical consequences (*what* actions were performed). Such discussions have been termed 'cognitive feedback' (Bordage, 1999) and focus on comparing the relative importance attributed to each clinical finding by students with the optimal discriminating findings of a particular case. Redundant findings or unhelpful aspects of a case are also highlighted. Computer-aided simulation of cases may be particularly amenable to

cognitive feedback, where large numbers of (sometimes similar) acute care scenarios could be presented to students in short periods of time.

7.7 Communication

In acute care contexts, newly qualified doctors are often reluctant to ask for help and have difficulty in communicating need and urgency to senior colleagues.

Evidence

Whilst much of the emphasis of communication skills teaching in primary medical training is focused on doctor-patient communication, the results presented in chapter 2, in accordance with previous research (Matheson and Matheson, 2009), highlight that newly qualified doctors are more likely to be challenged by communication with colleagues. The theme of 'the medical hierarchy' emerging in chapter 4 provides a fascinating insight into how newly qualified doctors conceptualise their relationships with senior colleagues. They attempt to guess the expectations of their colleagues, driven by a desire to demonstrate clinical independence and avoid seeking help (Kennedy et al., 2009). The theme of 'role and responsibilities' echoes previous work concluding that much of the anxiety characterising the transition from medical student to doctor can be attributed to feeling forced to take responsibility and the uncertainties of a new role (Illing et al., 2008, Paice et al., 2002). This thesis highlights the direct relevance of such concepts to the specific field of acute care, and reveals how newly qualified doctors' fears of falling short of the demands and expectations of their new role can lead to reluctance to seek help. The findings in chapter 6 reveal that even once the decision to ask for help has been made, newly qualified doctors are often unable to effectively communicate the specific help that is required or the urgency of the situation at hand. Furthermore, if the response of a senior colleague does not concord with the expected or desired outcome of the conversation, juniors frequently fail to highlight their dissatisfaction and concern.

Proposed educational strategies

(i) Both newly qualified doctors and their senior colleagues must take responsibility for the communication difficulties that occur in acute care contexts. In early postgraduate training, clinical supervisors should help to alleviate the predictable stress of transition by providing their juniors with explicit expectations of their role within an acute care context. Furthermore, senior doctors should be educated about the power of role-modelling and be advised to exemplify the help-seeking behaviours that they value in their junior colleagues. They should be encouraged to reflect on how their response to a request for assistance has consequences which reach beyond an individual patient's outcome by influencing the future behaviour of their junior colleagues when similar situations are encountered.

(ii) Primary medical training should equip students with strategies for dealing with interactions that they find challenging, with particular reference to urgent, high-stakes situations. Communication techniques such as SBAR (situation, background, assessment, recommendation) can assist all doctors in structuring their concerns, conclusions and perceived requirements, and are now widely taught in primary medical training programmes. Additional communication strategies for dealing with more challenging situations, such as a senior colleague's reticence to attend, should also be taught and rehearsed. Within the aviation industry, specific tools have been developed to facilitate the 'speaking up' of co-pilots to their captain when they harbour concerns (Ker and Patey, 2012). Developed from case studies of voice recorder transcripts of National Transportation Safety Board aircraft accident reports, PACE (probing, alerting, challenging, emergency warning) defines an ordered progression of statements which can be used by co-pilots to address concerns to captains (Besco, 1995). Similar, tailored techniques are required within the medical profession to facilitate difficult communication within the rigid hierarchy that newly qualified doctors find so disempowering.

7.8 Ethical principles in practice

Newly qualified doctors are aware of ethical frameworks but have difficulty in identifying the 'right' course of action when ethical principles conflict and the acuity of the situation necessitates an immediate decision.

Evidence

Several of the rule-based mistakes detailed in chapter 6 involved situations in which a critically unwell patient was not providing consent to life-saving treatment. On such occasions the simulated patients involved were usually too agitated or confused to understand the proposed treatment, and therefore lacked capacity. However, newly qualified doctors were often deeply uncomfortable instigating treatments for which specific consent had not been obtained. On occasion, confused or semi-conscious patients had life-saving treatment denied or even removed as a result of the junior's overarching concern for patient autonomy. Such decisions are closely associated with the 'acts and omissions' theme identified in chapter 4. The doctors who removed or denied patients potentially life-saving treatments were acting in accordance with their beliefs that *causing* harm (through what they believed was the direct violation of the patient's autonomy) was worse that *allowing* harm via the omission of treatment.

Proposed educational strategy

(i) Biomedical ethics features prominently throughout most primary medical programmes. However, much ethics teaching occurs in the early years, before students have become familiar with the complexities of clinical practice. Concepts such as the 'four principles' (Beauchamp and Childress, 2008), often learned and examined in ways that are removed from the realities of clinical practice, become indelibly printed in the minds of students. Facilitation of decision-making in acute care contexts would be aided by shifting ethics teaching into clinical attachments in later years, with an emphasis on real patient stories and dilemmas encountered or witnessed by students. Furthermore, a move away from the principles of bioethics to a more narrative approach to ethics may facilitate the application of ethics

teaching to practice (Nicholas and Gillett, 1997). Narrative approaches emphasise the importance of lived experiences, context and power (Rossiter, 1999), but do not preclude the use of the more traditional approaches as tools with which to explore the complexity of the workplace.

7.9 Summary of proposals

The challenges faced by newly qualified doctors in acute care contexts are complex and multi-faceted; consequently, so are the strategies by which such care can be improved. Newly qualified doctors will never feel fully prepared for this monumental challenge and error in such contexts will never be eliminated. However, through a combination of survey, literature review and original research, it is hoped that this thesis provides a new perspective and fresh ideas. The recommendations summarised in Figure 25 overleaf reach beyond newly qualified doctors; they involve other members of the multi-disciplinary team, particularly senior doctors, who are pivotal to enacting cultural change. Grounded in research findings, the modifications and additions to training which have been discussed within this chapter may, at least in part, hold the key to improving preparedness for professional practice and enhancing outcomes for acutely unwell patients.

Figure 25 - Summary table of problem statements and proposed educational strategies

Subject area	Problem statement	Proposed strategies
Hospital systems	Newly qualified doctors' lack of familiarity with hospital systems can be detrimental to patient care in acute care contexts	• Workplace-based learning and assessment • Amended FY1 induction procedures
Prioritisation	Newly qualified doctors have difficulty prioritising the tasks that are required in acute situations, and are often side-tracked by less important but more easily achievable goals	• Simulation training facilitating the repeated rehearsal of basic patient assessments
Procedural skills	Newly qualified doctors consider themselves to be relatively well prepared in procedural skills, but slips and lapses are commonplace in the stressful context of acute care	• Emotional skills training • The addition of distraction to the rehearsal of practical procedures
Situation awareness	In the dynamic and time-pressured context of acute care, newly qualified doctors struggle with assimilating the large volume of available information and utilising it to make illness severity judgements and projections	• Simulated scenarios with freeze and reflection • Error recovery training
Treatment	The misapplication of clinical 'rules' by newly qualified doctors can lead to the provision of inappropriate treatments in acute care contexts	• Computer-aided simulation of cases providing cognitive feedback
Communication	In acute care contexts, newly qualified doctors are often reluctant to ask for help and have difficulty in communicating need and urgency to senior colleagues	• Senior doctor education regarding role-modelling and articulation of expectations • Training in communication strategies for dealing with challenging situations
Ethical principles in practice	Newly qualified doctors are aware of ethical frameworks but have difficulty in identifying the 'right' course of action when ethical principles conflict and the acuity of the situation necessitates an immediate decision	• Narrative approaches to ethics teaching in the later years of medical school

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Appendix 1 - Preparedness for practice questionnaire

Educational Supervisors of Edinburgh Graduate FY1 Doctors

1. Educational Supervisors of Edinburgh Graduate FY1 Doctors Questionnaire

We are seeking feedback from you as an Educatonal Supervisor of Foundation Year 1 (FY1) doctors recently graduated from the University of Edinburgh. We are keen to find out how well the Edinburgh undergraduate degree programme prepared our students for medical practice, and whether there are areas of the curriculum which should receive particular attention in future.

Attached is a list of Edinburgh 2007 Graduated FY1s in the SE Scotland region and it would be very helpful if you could complete the questionnaire below with these Edinburgh graduates in mind.

Bearing in mind how Edinburgh graduates practised in the **early days of their first FY1 post**, please give your rating on how well prepared for practice you found them, under the following headings

1. Ability to carry out a consultation with a patient (history, examination.....)

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very Good

2. Ability to provide immediate care of medical emergencies, including First Aid and resuscitation

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very Good

3. Ability to assess clinical presentations, order investigations, make differential diagnoses, and negotiate a management plan

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

4. Ability to carry out practical procedures (e.g. venepuncture)

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

Educational Supervisors of Edinburgh Graduate FY1 Doctors

5. Ability to communicate effectively in a medical context

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

6. Ability to prescribe drugs

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

7. Ability to apply ethical and legal principles in medical practice

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

8. Ability to assess psychological aspects of a patient's illness

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

9. Ability to apply the principles, skills and knowledge of evidence-based medicine

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

10. Ability to use information and information technology effectively in a medical context

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

Educational Supervisors of Edinburgh Graduate FY1 Doctors

11. Ability to apply scientific principles, method and knowledge to medical practice and research

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

12. Ability to work effectively in a health care system and engage with population health issues such as social aspects of a patient's illness and health promotion

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

13. Ability to adopt a self-directed and reflective approach to own clincial practice, ongoing learning and professional development

- ◯ Poor
- ◯ Satisfactory
- ◯ Good
- ◯ Very good

14. Please provide comments to clarify any of your answers to the above questions

15. Are there any other specific points you wish to bring to the attention of the medical school in relation to undergraduate medical education in Edinburgh?

Appendix 2 - Medline search strategy and yield

Medline search strategy and yield

The following search was undertaken on 11th September 2011. All prefix and suffix instructions, abbreviations and symbols are used as defined in the OVID gateway.

#	Searches	Results
1	foundation doctor*.tw.	21
2	foundation train*.tw.	17
3	FY1*.tw.	95
4	foundation year 1.tw.	13
5	foundation year one.tw.	2
6	(foundation adj3 train*).tw.	76
7	(foundation adj3 doctor*).tw.	101
8	new* qualif* doctor*.tw.	72
9	PRHO*.tw.	106
10	houseman*.tw.	30
11	house man*.tw.	58
12	house officer*.tw.	1566
13	(medic* adj3 graduat*).tw.	5906
14	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13	7804
15	Programme Evaluation/	37093
16	exp Professional Competence/	68128
17	exp Curriculum/	54802
18	(prepar* adj3 practi*).tw.	1968
19	15 or 16 or 17 or 18	146473
20	exp great britain/ or ireland/	272563
21	14 and 19 and 20	274
22	limit 21 to yr="1993 - Current"	256

Appendix 3 - Quality scoring

Quality scoring of included papers

One of the eleven studies (Lempp et al., 2005) was given a BEMEQI score of less than seven by both reviewers working independently, and was therefore excluded from the review.

Paper	Quality score from SES	Quality score from VRT
Berridge et al., 2007	10	9
Brown et al., 2010	8	8
Clack, 1994	9	9
Evans and Roberts, 2006	7	7
Goldacre et al., 2010	11	11
Illing et al., 2008	9	9
Lempp et al., 2004	7	7
Lempp et al., 2005	6	6
Matheson et al., 2010	8	7
Tallentire et al., 2011b	9	9
Wall et al., 2006	7	7

Appendix 4 - Focus group consent form

NHS Lothian

Acute Care Focus Group

Consent Form

This session is being used to collect anonymous information on the behaviour of newly qualified doctors in acute care contexts.

Please read carefully and sign below.

- I hereby consent to the focus group being audio-recorded and the recordings used for medical educational research only.
- I understand that the recordings will be heard only by those directly involved in this research and will not be passed to any other party now or in the future.
- Whilst I may be quoted in educational research, I will not be identified at any stage and no comments or opinions will be attributed to me personally.
- All data obtained and processed will be done so in accordance with the Data Protection Act 1998.
- I hereby assign copyright of any material obtained, for the purposes stated above, and understand that no payment will be offered in return.
- I will treat any information gained in relation to patients or colleagues as part of this session with the same confidentiality as applies to my clinical practice.

Print name.....

Description of clinical post.....

Signature.....Date.....

Signature of researcher.....Date.....

Appendix 5 - Focus group schedule

Focus Group Schedule

Introduction

Use to develop rapport, introduce the group to each other and give plenty of opportunities for questions.

- Introductions
- Purpose of group
- Consent form
- Refreshments provision
- Opportunity for questions

Initial questions

Use, as and when required, to stimulate discussion in the initial stages of the session.

- What factors do you feel affect newly qualified doctors' behaviour when caring for acutely unwell patients?
- How do newly qualified doctors cope when faced with an acutely unwell patient?
- In what ways does their undergraduate training prepare them to deliver care to an acutely unwell patient?

Issues raised in previous groups

Evolving issues discussed in previous groups or touched on earlier in the session. Try to build on previous explanations and ideas

Close

- Offer to view recording or transcript
- Availability for further respondent validation
- Further opportunity for questions
- Thanks

Notes for self

- *Try to highlight inconsistencies between participants in non-confrontational ways as a way of encouraging deeper exploration of views or beliefs.*
- *Encourage the exchange of ideas and anecdote.*
- *Ask participants to comment on the views and experiences of others.*

Appendix 6 - Simulation consent form

NHS Lothian

FY1 Shadowing Week Simulated Acute Scenarios

Consent Form

This session forms an optional part of your shadowing week experience at the Western General Hospital. It is also being used to collect anonymous information on how well prepared FY1s feel in relation to acute care skills.

Please read carefully and sign below.

- I hereby consent to my simulation session (scenario and debrief) being videotaped and the recordings used for tutor training purposes and medical educational research only.
- I understand that the recordings will be viewed only by those directly involved in this educational venture and will not be passed to any other party now or in the future.
- Whilst I may be quoted in educational research, I will not be identified at any stage and no comments or opinions will be attributed to me personally.
- All data obtained and processed will be done so in accordance with the Data Protection Act 1998.
- I hereby assign copyright of any material obtained, for the purposes stated above, and understand that no payment will be offered in return.
- I agree to not discuss the performances of my colleagues in this session in either in a clinical or social setting.

Print name.....

Signature.....Date.....

Signature of researcher.....Date.....

Appendix 7 - Published papers

Exploring Error in Team-Based Acute Care Scenarios: An Observational Study From the United Kingdom

Victoria R. Tallentire, MBChB, MRCP, Samantha E. Smith, MBChB, Janet Skinner, MBChB, FRCS, FCEM, and Helen S. Cameron, MBChB, MRCP

Abstract

Purpose

To investigate the errors made by junior doctors (first year after primary medical qualification) in simulated acute care settings, using (and, for some purposes, amplifying) a previously published generic error-modeling system (GEMS). Possible error types were skill-based slips and lapses, rule-based mistakes, knowledge-based mistakes, and violations.

Method

In August 2010, 38 junior doctors participated in high-fidelity simulated acute care scenarios in NHS Lothian, Scotland. Each video-recorded scenario was immediately followed by an audio-recorded debrief that encouraged articulation of underlying cognitive processes. Two researchers used evidence from the scenario, debrief, and field notes to determine which errors were attributable to a single underlying cause. In such cases, the errors were coded by template analysis into the GEMS framework. Errors for which a single cause could be identified but which did not fit the framework were coded inductively.

Results

A total of 243 errors were identified, with sufficient evidence available to identify a single cause in 190. Skill-based slips and lapses, rule-based mistakes, and knowledge-based mistakes were all clearly identified within the data. Two error types not originally included in the GEMS framework were identified: compound errors and submission errors.

Conclusions

Amplification of GEMS provides a valid framework for categorization of the errors made by junior doctors in simulated acute care contexts. In addition, the amplified framework may be transferable to other, team-based contexts. An improved understanding of the knowledge and skills that are most vulnerable to each specific type of error will allow tailored educational strategies to be developed.

The survival of critically ill patients depends on care that is prompt and error free.[1] Within the United Kingdom's health care system, deteriorating inpatients are often assessed and treated, at least initially, by teams of ward-based junior doctors (doctors within their first year of practice after attainment of a primary medical qualification). Because of competing time demands, senior doctors (specialist doctors with at least four years of postqualification experience) are often not immediately available. Consequently, junior doctors are expected to contact the appropriate specialists according to their assessment of the patient's condition and the urgency of the situation at hand. Despite the ability to "provide immediate care in medical emergencies"[2] being a General Medical Council–mandated outcome of all UK primary medical degree courses, acute care is an area in which new graduates feel consistently poorly prepared.[3,4] This perception is supported by data suggesting that patients admitted on the day that junior doctors commence work in the United Kingdom have an in-hospital death rate 6% higher than those admitted a week previously.[5] The combination of time pressure, dynamic conditions, and heavy information load afforded by acute situations provides fertile ground for error.[6,7]

The causes of medical error are diverse and complex, involving both individual and systems factors.[8] As the contribution of human error to suboptimal health care outcomes is increasingly understood, a plethora of error-modeling frameworks and taxonomies have been developed which attempt to facilitate deeper exploration and understanding.[9–11] However, much of the contemporary discourse within the medical education literature in relation to medical error emphasizes diagnostic error,[12–17] despite the fact that "diagnostic reasoning is only one part of the equation."[18] One of the unique challenges of acute care is the necessity to instigate generic resuscitative measures whilst concurrently collating clinical information to aid diagnosis and guide specific management. In the context of hospital inpatients, diagnosis formation may be either aided or hindered by prior knowledge of a patient's condition, which may not necessarily be relevant to the acute deterioration. Consequently, the exploration of errors made in acute care contexts should not start with diagnosis but, rather, should explore all of the actions undertaken during initial assessment and treatment. The cognitive processes underlying other decisions such as seeking help, judgment of illness severity, and initial investigation choice may provide new insights into the causes of clinical error in the context of acute care. An additional challenge in the care of acutely unwell patients is the fact that doctors rarely make decisions in isolation but, instead, tend to work in teams to plan and provide initial resuscitation and ongoing care.

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The conceptual framework we used for this study was the generic error-modeling system (GEMS) devised by James Reason[19] but heavily influenced by Rasmussen's[20] skill-rule-knowledge classification of human performance. GEMS was chosen for this study because it provides a practical and logical framework which recognizes the importance of both observed behavior and cognitive processing. Since its inception, GEMS has been developed in a variety of ways, including subdivision of the categories[21] and amalgamation with other conceptual frameworks.[11] Such modifications have been particularly useful in the context of systems improvement[10,22] but seem less applicable to error exploration as a means of driving educational innovation at the level of the individual, where theoretical detail can dilute the potential for practical application. Consequently, we chose to use the original broad version of GEMS for this study. Recent work by Dornan and colleagues[23] employed the same broad framework to categorize prescribing errors using information obtained during critical incident debriefing. Other previous studies have also identified the value of retaining broad classifications, although such work has thus far been restricted to the field of prescribing,[22,24] an activity which is often undertaken alone and rarely involves the complex, multimodal interactions observable in team-based acute care.

Definitions, explanations, and examples of the four error types described by Reason are given in Table 1. Skill-based slips and lapses, rule-based mistakes (RBMs), and knowledge-based mistakes (KBMs) are all types of *unintentional* error.[19] Violations are *intentional* aberrant behaviors which, unlike the other error types, are judged against the social and organizational context within which actions occur and not merely against one's own intentions.[19]

In this constructivist study, we aimed to answer the following questions: Can GEMS be used to classify the errors made by junior doctors working in small teams, using simulated acute care scenarios to provide the contextualized data? And how can the framework be amplified to accurately reflect the range of errors made by junior doctors working in small teams?

Method

Setting and population

The study was conducted in NHS Lothian, one of the 14 district National Health Service (NHS) boards in Scotland. Newly qualified doctors employed by NHS Lothian undertake a three-day induction program immediately before commencing work. Participation in this study was an optional component of the induction program delivered in August 2010 at the Western General Hospital in Edinburgh. With the prior agreement of the associate dean for foundation training in the South East Scotland deanery and the director of medical education in NHS Lothian, we e-mailed all junior doctors due to commence work at the Western General Hospital and invited them to take part in the study.

Design

Whereas the observation of authentic clinical practice is limited by both practical difficulties and ethically unjustifiable patient safety implications, simulated scenarios allow the observation of clinical skills, behaviors, and responses in an environment that does not expose patients to harm. We thus employed high-fidelity simulation to provide the contextualized data for this study, rather than in its more usual role as an educational tool. Between January and July 2010, eight simulated scenarios involving acutely unwell patients were designed and electronically programmed by three clinicians (V.R.T. and two anesthetic consultant colleagues with

Table 1

Definitions, Explanations, and Examples of the Error Types Described in Reason's Generic Error-Modeling System*

Error type	Definition	Explanation	Everyday example
Skill-based slips and lapses	"Errors which result from some failure in the execution [slip] and/or storage [lapse] stage of an action sequence."	Slips are often caused by attention failures during a task, whereas lapses result from memory failure prior to task commencement.	Your guest would like tea and you prefer coffee. You walk into the kitchen intending to make the correct drinks, but you return with two cups of coffee.
Rule-based mistakes	"The mistake arises from the application of a 'bad' rule or the misapplication of a 'good' rule [a rule of proven worth]."	A rule formed from prior experience or existing knowledge is either misapplied or is inherently flawed.	Piles of paper to be recycled are left next to the front door. You put a pile of papers left there in the recycling bin, only to discover that your partner left them by the door as a reminder to take them to a meeting.
Knowledge-based mistakes	Mistakes arising from "the more laborious mode of making inferences from knowledge-based mental models of the problem space."	Attempts to pattern-match have failed, and a lack of preprogrammed solutions necessitates effortful, conscious processing.	You are attempting to bake a cake for the first time. You do not realize that the oven door should remain closed, and, halfway through the baking time, you open the oven door to check the progress, causing your cake to sink.
Violations	"Deliberate—but not necessarily reprehensible—deviations from those practices deemed necessary to maintain the safe operation of a potentially hazardous system."	Intentional deviations from correct protocols or routine courses of action, often in an effort to save time or effort by taking "shortcuts."	You are late for an important meeting and are held up for 10 minutes by a slow-moving bus. After overtaking the bus, you drive slightly over the speed limit for the remainder of the journey.

*Source (including direct quotations): Reason J. Human Error. Cambridge, UK: Cambridge University Press; 1990.

particular interests in simulation education). We repeatedly piloted all scenarios using a total of 16 junior doctors who were not study participants. The junior doctors provided feedback on the difficulty and clinical credibility of the scenarios, and the programming was refined to create scenarios that were reproducible and realistic. The four ward-based scenarios used for the study were those which performed most consistently and received the most positive feedback in the pilots: postoperative hemorrhage, severe sepsis, postoperative respiratory distress, and hypoglycemic coma.

The simulated environment consisted of a single, full-body, adult mannequin simulator (Emergency Care Simulator, Medical Education Technologies, Inc., Sarasota, Florida) accompanied by monitoring equipment, drugs, and other supplies as available on a general medical or surgical ward. Three ceiling-mounted cameras allowed each scenario to be filmed from a variety of perspectives and relayed real-time to the control room. The fidelity of the simulated patient was enhanced by a patient voice transmitted via a wireless microphone, dynamic physiology, and realistic clinical examination findings. A bedside monitor provided physiological parameters when requested by participants. A telephone handset was connected directly to the control room, and a member of the study team previously unknown to the participants played the role of a ward nurse, capable of a finite, predefined range of tasks. Because this study focused on the errors made by the junior doctors, the nurse helper neither provoked nor prevented errors from occurring, but did provide accurate and helpful advice whenever it was requested.

Data collection

After a briefing that covered room layout, nurse helper capabilities, and mannequin features and limitations, the junior doctors were placed in groups of two or three. They were given information regarding the patient's age, reason for admission to hospital, and current presenting symptom, and they were then invited to assess and treat the patient (mannequin) within the simulated setting. Observation of participants in teams rather than alone replicated the realities of clinical practice and encouraged verbalization of decisions and ideas. Each simulated scenario lasted between 20 and 25 minutes and was video-recorded (with audio). It was immediately followed by an audio-recorded debrief conducted by one of three trained senior clinicians (V.R.T. and two consultant anesthetic colleagues), which lasted between 30 and 40 minutes. Debriefing was aided by immediate playback of the scenario and encouraged articulation of the cognitive processes which had occurred, particularly in relation to the errors observed. Field notes were taken by the principal researcher (V.R.T.) during and immediately after both the simulated scenarios and the debrief discussions.

Analysis

We conducted our analysis using the scenario video recordings, debrief audio recordings, and field notes. The video recordings of all 18 scenarios were reviewed by two clinician researchers (V.R.T. and S.E.S.). During video review, identification of an error prompted the researchers to pause the video and discuss the error in detail with each other, informed by referral to current resuscitation guidelines. All errors were attributed to the team of doctors rather than to a single participant, except when evidence existed for the same error having been made by more than one participant for different reasons. In such cases, the richness of the data was preserved by giving individual consideration to the actions of each participant, recorded as distinct errors. Observation of a single participant involved noting aspects of behavior, along with verbal and body language clues which helped to explain erroneous actions.

Immediately after review of each video recording, both researchers listened to the audio recording of the corresponding debrief in an attempt to glean additional information pertaining to the participant intentions. Audio recordings were chosen in preference to transcriptions because the presence of intonation or emphasis helped researchers to more accurately interpret the meaning of some participants' comments or questions. After assimilation of the evidence, each error was reviewed in the context of the scenario and debrief to determine whether there was sufficient evidence to attribute the error to a single cause. In cases where a single cause was evident, the error was coded into the GEMS framework by template analysis.[25] Errors which could not be coded into the GEMS framework were coded inductively.

Ethics

Ethical approval was waived by the South East Scotland Research Ethics Service. We obtained written consent for audio and video data collection and publication of anonymized results from all participants.

Results

All 38 junior doctors who were invited to be involved in the study participated in 18 simulated scenarios in pairs or threes. Participants included graduates from seven UK medical schools. In total, 243 errors were identified (range 8–20 errors per scenario). Sufficient evidence was available to attribute 190 of the errors to a single cause. For the 53 remaining errors, there was insufficient evidence from the scenario, debrief, and field notes to confidently attribute the error to one of a number of possible explanations.

It was possible to classify 164 of the errors according to GEMS without modification to the framework. An additional 26 errors were classified in new categories, which we propose below as an amplification of GEMS when used in a team-based context.

The existing GEMS framework

Slips relate to the execution phase of a task, whereas lapses result from failure of the storage phase and usually occurred when there was either a time lag or distraction between the formulation and execution of the plan. RBMs stemming from both the misapplication of "good" rules (those with proven utility in a particular context) and the application of "bad" rules were identified. Good rules were often misapplied when the clinical situations presented to the junior doctors shared some common features with the circumstances in which the chosen rules are pertinent. The clinical features which indicated that the rule being applied was inappropriate tended to be ignored by the junior doctors.

KBMs were, by definition, associated with situations that the junior doctors had not previously encountered. They related to many forms of knowledge, including clinical aspects, hospital systems, and medical equipment. Violations occurred in situations when the correct procedure

Table 2

Examples of Four Types of Error Made by 38 Junior Doctors in Simulated Acute Care Scenarios, NHS Lothian, United Kingdom, 2010*

Type of error	Description of error (scenario number)	Evidence from scenario (S) or debrief (D)
Skill-based slips and lapses		
	Tells senior colleague on the phone that the patient's heart rate is 98 beats per minute. (10)	(S): Monitor shows that the heart rate is 130 beats per minute and the oxygen saturations are 98%.
	Fails to order chest X-ray for patient in respiratory distress, despite volunteering to do so. (5)	Junior (S): "We need a chest X-ray." Reply from other junior: "You call for help and I'll do that." (unable to do so as colleague uses the phone and never returns to the task)
	Patient's notes not checked for current medications as possible cause of hypoglycemic coma. (7)	Junior (D): "I completely forgot about the kardex [drug chart], that's when I was going to read that he was diabetic, and then the phone went." [referring to his plan to review the drug chart]
Rule-based mistakes		
	Treats patient with partial airway obstruction secondary to hypoglycemic coma with nebulized salbutamol, requiring oxygen to be reduced. (7)	Junior (D): "He wasn't wheezy, I know. I listened to his chest." Tutor: "Why did you think it was asthma?" Junior: "Because there was noisy breathing and a fast respiratory rate."
	Patient in septic shock with no evidence of cardiac dysfunction treated with 500 mL of saline across one hour. (3)	Junior (S): "I don't want to put him into heart failure, let's put it over an hour." [discussing intravenous fluid prescription with nurse]
	Juniors aware that senior help is not arriving for 20 minutes and patient is having a major postoperative bleed. (17)	Tutor (D): "Did 2222 [emergency call] cross your mind?" Junior: "Yes it did at one point." Tutor: "Why didn't you call it?" Junior: "I felt like the patient's consciousness wasn't impaired."
Knowledge-based mistakes		
	Recognition of partial airway obstruction but no simple maneuvers attempted and no advice sought. (7)	Junior (S): "He's sounding very obstructed; he's got an obstructed airway." Reply from other junior: "We can't do anything about it, can we?"
	Recognition of severe sepsis but no attempts made to give antibiotics. (18)	Tutor (D):"Did the patient get antibiotics?" Junior: "No, because I didn't know how to administer them."
	Patient with major postoperative bleeding is causing concern, but no attempt is made to obtain senior help. (17)	Junior (D): "I was thinking about maybe calling the anesthetist. I was thinking: I need an anesthetist, where do I get one of those?'"
Violations		
	Feels patient's pulse but does not count rate or ask for any monitoring. (11)	Junior (S): "He's got a pulse as well; I can't tell the rate, I don't have a watch."
	Junior has just checked first unit of blood correctly. Nurse passes second unit of blood to junior and asks for it to be checked. Junior looks at the patient's notes for several seconds and then passes blood back to nurse, stating it has been checked when it has not. (12)	Junior (S): "Yes, that's checked as well."
	Sends cross-match sample to blood bank despite being unsure of whether the details on the tube and corresponding form have been completed correctly. (14)	Porter (S): "Is it labeled properly this time?" Reply from junior: "I'm not sure."

*High-fidelity scenarios were conducted with two or three junior doctors working in collaboration. Debriefing was conducted by a senior clinician and involved the junior doctors who had just participated in the scenario. Error analysis involved both scenario and debrief recordings.

or protocol was known to the juniors but compliance would have introduced a time delay or the necessary equipment was not readily available. Examples of each of the types of error that could be classified according to the original version of GEMS are shown in Table 2.

Proposed modifications to the GEMS framework

Compound error. Some errors occurred solely because of a preceding error; we have thus termed them "compound errors." This category includes errors stemming from the misunderstandings of others, as well as from a junior's own misperception or misinterpretation of information. Two examples of compound errors are shown in Table 3.

Submission error. At times, there was disagreement between the junior doctor participants as to the most appropriate course of action. The data revealed a second error type which has not been previously described in association with GEMS: submission error. Such an error occurred when a junior doctor was dissuaded from taking the most appropriate course of action by another participant advocating less appropriate measures. This type of error is clearly only applicable in situations where multiple individuals are working toward a common goal. Two examples of submission errors are shown in Table 3.

Discussion and Conclusions

Our findings demonstrate that Reason's GEMS provides a valid framework for categorization of the errors made by junior doctors in simulated acute care contexts. We clearly identified examples of skill-based slips and lapses, RBMs, KBMs, and violations in the data from the video-recorded scenarios and audio-recorded debriefs. We have also proposed two new types of error: compound errors and submission errors.

In their work on junior doctors' prescribing errors, Dornan and colleagues[23] modified GEMS by the addition of a category called "communication error." This additional category was used to describe prescription errors resulting from the receipt of erroneous information from patients or other health care professionals. Within this study, we attributed all errors to the team of doctors rather than to a single participant, except when evidence existed for the same error having been made by more than one participant for different reasons. Dornan and colleagues' "communication errors" are therefore a subset of the wider group of compound errors observed in this study.

When a junior doctor commits an error due to incorrect information provided by another health care professional, Dornan and colleagues[23] have noted the inevitable consequence of the junior becoming mistrusting of information given to him or her by other members of the team. We have demonstrated a second type of compound error stemming from the misperception or misinterpretation of information by oneself. The fallibility of human perception and memory systems is well documented in the cognitive psychology literature,[26] but such concepts have been much slower to penetrate medical education research and curricula design. Elevated stress levels have been shown to impede performance in a multitude of cognitive processes required in acute care contexts, including those that involve divided attention, working memory, retrieval of information from memory, and decision making.[6] Recent calls for training in error recovery,[27] as complementary to more popular error-reduction strategies,[28] may hold the key to developing junior doctors' abilities to recognize error in both their colleagues and themselves. Rather than mistrusting their professional colleagues, developing an awareness of how affect and emotion can influence behavior may promote patient safety by prompting junior doctors to be less trusting of their own cognition in stressful, high-stakes situations.

Submission errors are restricted to situations in which teamwork is required. In this study, all participants had the same level of education and comparable clinical experience. We must assume,

Table 3

Examples of Compound and Submission Errors Made by 38 Junior Doctors in Simulated Acute Care Scenarios, NHS Lothian, United Kingdom, 2010*

	Description of error (scenario number)	Evidence from scenario (S) or debrief (D)
Compound errors		
	Junior uses observation chart as a surrogate for current physiology and then provides insufficient oxygen to patient. (9)	Junior (D): "We had the patient on a Hudson [variable performance] mask ... 97% sats [oxygen saturation] so didn't think we need to jump in with all guns blazing."
	Junior tells senior colleague on the phone that a 12-lead ECG has been performed when it has not; it had merely been mentioned to the nurse. (5)	Junior (D): "When she was asking me what tests we had done and for information on what we'd done, you know, we seemed to have covered all the bases."
Submission errors		
	One junior is very keen to call for senior help but is dissuaded from doing so by another junior who insists on the requirement for investigation results prior to calling. (9)	Junior (S): "Should we get an SHO [more senior doctor] here?" Reply from other junior: "I suppose we need to send the bloods first, and get an ECG [electrocardiogram]."
	Aware patient is bleeding; one junior is keen to use blood as primary resuscitation fluid but is persuaded by another junior not to request any blood from blood bank. (2)	Junior (S): "I think we should just give more fluid." Reply from other junior: "But if she's bleeding blood then we should give her blood." Junior: "... can we not just keep giving her saline, or jelly [colloid] or something?"

*High-fidelity scenarios were conducted with two or three junior doctors working in collaboration. Debriefing was conducted by a senior clinician and involved the junior doctors who had just participated in the scenario. Error analysis involved both scenario and debrief recordings.

therefore, that participants' willingness to deviate from their first-choice strategy reflected a lack of confidence, either in their clinical decision making or in their ability to convince others of the correct course of action. There were times, however, when junior doctors were diverted away from an inappropriate course of action and "saved" from poor decisions by the decisiveness of their colleagues. It would, therefore, be unwise to advocate obstinacy on the part of junior doctors; instead, distributed situation awareness and shared decision making should be encouraged. In contrast to the conventional model of situation awareness ("the perception of elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future"),[29] distributed approaches to situation awareness recognize the dynamic interactions between the junior doctors, other health care professionals, and the patient.[30] The sharing of information, ideas, and projections was conspicuously absent from the scenarios in which an appropriate course of action was traded for a less appropriate one. Within the rigid hierarchy of hospital medicine, one might reasonably assume that the junior doctors in this study may be even less willing to highlight the perceived errors of their senior colleagues than they were to challenge their peers in the "safe" environment of simulation.

Limitations

This study used the observation of high-fidelity simulated practice of junior doctors trained at various institutions to inform and amplify an existing error framework. However, it is probable that we did not identify all of the errors made in each scenario, and the identification of error was likely to be influenced by our own experiences and interests. Many of the errors observed could not be attributed to a single cause because of insufficient evidence from either the scenario or debrief recording. This may reflect a lack of debriefing time, participants' reluctance to discuss particular errors, or the complexity of decision making in acute care contexts.

It is possible that, in the artificial environment of simulated scenarios, the junior doctors behaved in ways that did not reflect their behavior in everyday clinical practice, particularly in relation to violations. The risk of such discrepancy was minimized by the use of high-fidelity simulation and the absence of senior clinicians within the scenarios. Discussions between juniors during scenarios focused on their actions rather than omissions, and, as such, errors of omission were more difficult to identify and, subsequently, classify. Consequently, scenarios containing long periods of inactivity presented relatively few opportunities for error classification. As with all forms of interview, the collection and analysis of data will have been influenced by the social context of the discussion,[31] particularly the power dynamics inherent within the hierarchy of clinical medicine. Our attempts to create a relaxed debriefing environment were unlikely to have negated the inhibitory effect of senior clinician presence. The junior doctors may have chosen to amend the explanations of their actions to be consistent with the perceived agenda of the facilitator.

Implications and further work

This study demonstrates that applying GEMS to the analysis of error may help to illuminate acute care error from a new perspective and suggests that the emphasis on diagnostic error within contemporary medical education discourse gives an incomplete picture when applied to acute care error. GEMS provides a pragmatic framework that incorporates, but is not restricted to, diagnostic error. We have adapted GEMS for use in acute care, and this amplified framework may be transferable to other situations involving close team working in small groups. Compound errors and submission errors almost certainly occur in other medical and nonmedical contexts, and future work could also focus on evaluating the extent to which the amplified framework is transferable to other fields. In terms of specific error types, it would be particularly interesting to explore the contributions of factors such as personality type and self-confidence to the occurrence of submission errors.

If the survival of critically ill patients is to be improved, the behavior of the junior doctors who constitute the first responders in such situations needs to be more fully understood. The multiplicity of influences on their behavior at this crucial time,[32] commonly combined with diagnostic uncertainty and high-stakes outcomes, means that errors are somewhat inevitable. The amplified version of GEMS could be used in future studies to identify the knowledge and skills that are most vulnerable to specific error types, allowing tailored educational strategies to be developed.

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PRESS RELEASE

EDITOR'S CHOICE

The preparedness of UK graduates in acute care: a systematic literature review

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ABSTRACT

Purpose of study The ability to recognise acutely unwell patients and to instigate generic resuscitation is essential for all newly qualified doctors. The aim of this review is to synthesise recent work examining the perceived preparedness of UK medical graduates in acute care, relative to the other outcomes detailed in Tomorrow's Doctors (2009).

Study design A systematic literature search was performed using five databases. It sought literature related to preparedness in acute care and other Tomorrow's Doctors outcomes from the perspectives of the graduates themselves and their professional colleagues. Two researchers undertook data extraction and quality scoring, and preparedness ratings in each outcome were mapped to a generic rating scale to allow comparison between studies.

Results 256 articles were recovered, with 10 included in the final analysis. The 10 articles suggested that graduates perceive themselves to be least well prepared in acute care and prescribing. Their professional colleagues perceive them to be less prepared in acute care than in any of the other outcomes and perceive preparedness in acute care to have declined since the first publication of Tomorrow's Doctors. Furthermore, there is evidence that preparedness in acute care is an area of concern for UK graduates.

Conclusions The assimilation of evidence in this review suggests that recent changes in UK undergraduate training, while improving preparedness in some areas, may have neglected acute care. While not a good surrogate for actual preparedness, perceived preparedness is important in influencing the behaviour of new graduates and therefore warrants further consideration.

INTRODUCTION

The fundamental aim of any primary medical educational programme is to adequately prepare students for clinical practice.[1] In 1993, the General Medical Council published the first version of Tomorrow's Doctors,[2] a document designed to guide UK medical school curricula. Its recommendations prompted all UK medical schools to initiate major curricular reforms and provided a clear framework against which preparedness could be evaluated. Despite these reforms, only 59% of 2004 graduates[3] and 58% of 2005 graduates[4] agreed that their medical school had adequately prepared them for their first post.

The vast majority of graduates from UK medical schools proceed to the Foundation Programme, which consists of 2 years of largely hospital-based training known as Foundation Year 1 (FY1) followed by Foundation Year 2 (FY2). The third edition of Tomorrow's Doctors published in 2009[1] lists 16 outcomes which graduates must be able to demonstrate in order to be 'properly prepared for clinical practice and the Foundation Programme'.[1] One such outcome is the ability to 'provide immediate care in medical emergencies'.[1] This outcome has relevance to all specialities, whether hospital or community based, and the potential to reduce mortality by focusing on the delivery of care to this vulnerable group of patients is increasingly being recognised by healthcare improvement agencies throughout the developed world.[5 6] It is of the utmost importance to senior colleagues, prospective employers and, of course, current and future patients that medical graduates feel able to recognise acute illness and institute generic resuscitative measures while awaiting senior assistance.

Aim

The overarching aim of this review was to investigate the perceived preparedness of UK medical graduates in acute care relative to the other outcomes detailed in Tomorrow's Doctors (2009). More specifically, the objectives were to establish the following:

- how perceived preparedness in acute care compares with perceived preparedness in other Tomorrow's Doctors (2009) outcomes;
- how the change in perceived preparedness in acute care over time compares with the change in perceived preparedness in other Tomorrow's Doctors (2009) outcomes over the same period;
- whether preparedness in acute care is a source of concern.

All three objectives were examined in relation to self-perceptions and those of other healthcare professionals.

METHODS

Search strategy

On 11 September 2011, the search strategy shown in box 1 was used to recover relevant articles. Medical Subject Headings were used infrequently, as they have not been designed for the purpose of recovering medical education articles and consequently yield large numbers of irrelevant articles.

All prefix and suffix instructions, abbreviations and symbols were used as defined in the Ovid Gateway.[7] The search was limited to articles published from 1993 onwards, when the first publication of Tomorrow's Doctors provided an explicit framework for evaluation of preparedness for practice. Equivalent searches were carried out in five databases: MEDLINE, Education Resources Information Center, Embase (Exerpta Medica), Cumulative Index to Nursing and Allied Health

Box 1 Search strategy

1. Foundation doctor*.tw OR foundation train*.tw OR FY1*.tw OR foundation year 1.tw OR foundation year one.tw OR (foundation adj3 train*).tw OR (foundation adj3 doctor*).tw OR new* qualif* doctor*.tw OR PRHO*.tw OR houseman*.tw OR house man*.tw OR house officer*.tw OR (medic* adj3 graduat*).tw
2. Programme Evaluation/OR exp Professional Competence/OR exp Curriculum/OR (prepar* adj3 practi*).tw
3. exp Great Britain/OR Ireland/
4. 1 AND 2 AND 3
5. Limit 4 to yr='1993–Current'

Literature and PsycINFO (American Psychological Association). Titles and abstracts were recovered for all search results.

Inclusion criteria

Articles were included if they fulfilled all of the criteria listed in table 1. In the case of any doubt regarding inclusion, the full article was recovered and used to assess suitability. The reference lists of all articles fulfilling the inclusion criteria were searched for other relevant articles that may have been missed by electronic searching.

Data extraction

Data extraction and quality scoring of all articles fulfilling the inclusion criteria were undertaken by two researchers independently (VRT and SES), each with a clinical background and educational research experience. All data were collated onto a pre-prepared data extraction form in Excel (Microsoft Office 2007). Discrepancies were resolved by discussion until agreement was reached.

The following data were extracted for all included articles:

- location of study (medical school or deanery);
- number and grade of participants;
- method(s) of data collection;
- year of graduation;
- time since graduation;
- Tomorrow's Doctors (2009) outcomes evaluated;
- summary of perceived preparedness relative to each outcome;
- quality of study.

Table 1 Inclusion criteria

Inclusion criterion	Justification
1. The article contains information on perceived preparedness in acute care as defined in paragraph 16 of Tomorrow's Doctors (2009), 'provide immediate care in medical emergencies'.[1]	Acute care is the focus of the review, and Tomorrow's Doctors (2009) is the template chosen to compare studies included in the review.
2. The article is related to the transition from medical student to practising doctor.	This review focuses on preparedness for practice as a new medical graduate. This criterion therefore excludes studies of preparedness for other transitions such as that from specialty training to consultancy.
3. The article is either primary empirical research or course evaluation.	This criterion excludes case studies, editorials and opinion pieces which, while of interest, do not provide empirical data.
4. The work originates from a UK medical school or deanery.	The aim of this review is to focus on preparedness of UK graduates. Given the differences in the structure of training and hospital systems elsewhere, only UK studies are relevant to the research question.

Quality scoring

The methodological quality of each included study was assessed using the Best Evidence in Medical Education quality indicators (BEMEQI) developed by Buckley *et al* and summarised in table 2.[8] BEMEQI was chosen from the many methodological scoring systems in existence due to its relevance to the studies included in the review. Studies were considered to be of high quality if they met seven or more of the 11 quality indicators, as originally proposed by Buckley *et al* and employed elsewhere.[9] Studies with a BEMEQI score of <7 were excluded from the review.

RESULTS

The initial search undertaken using the MEDLINE database yielded 256 articles. Six articles were considered to fulfil all inclusion criteria. Equivalent searches in Education Resources Information Center, Embase, Cumulative Index to Nursing and Allied Health Literature and PsycINFO yielded two new articles, and hand searching of reference lists yielded three more.

One of the 11 studies[10] was given a BEMEQI score of <7 by two researchers working independently and was therefore excluded from the review. Five of the remaining ten studies evaluated the preparedness of graduates of English universities,[11–15] one study investigated preparedness of graduates of a Scottish university,[16] one multicentre study included graduates from two English and one Scottish universities[17] and another surveyed graduates of all UK medical schools.[4] One study evaluated doctors practising in the West Midlands deanery,[18] and another focused on doctors working in two hospitals in the North East Thames region.[19]

All 10 studies explored preparedness as perceived by newly qualified doctors within their first year of practice. Two studies surveyed doctors between 1 and 3 years post graduation,[4 12] and one study explored the perceptions of doctors with up to 8 years of clinical experience.[13] Four studies sought the views of consultants or educational supervisors on the preparedness of their junior colleagues,[12 16–18] and one study incorporated the perceptions of nursing staff and other allied health professionals.[17]

Six of the studies contained quantitative ratings of preparedness that could be mapped to paragraph 16 of Tomorrow's Doctors (2009).[1] Table 3 shows the number of studies providing

Table 2 A summary of the Best Evidence in Medical Education quality indicators (BEMEQI) adapted from Buckley *et al*[8]

Quality indicator	Detail
Research question	Is/are the research question(s) clearly stated?
Study subjects	Is the study group appropriate (size, characteristics, selection)?
Data collection methods	Are the methods reliable and valid?
Completeness of data	What is the drop out/attrition/response rate?
Control for confounding	Have confounding variables been removed/minimised/accounted for?
Analysis of results	Are the methods of analysis appropriate?
Conclusions	Can the data justify the conclusions?
Reproducibility	Could the study be repeated by another group?
Prospective	Is the study prospective (forward looking), as opposed to retrospective?
Ethical issues	Were ethical issues addressed adequately?
Triangulation	Are the results supported by data from other studies?

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Table 3 Numbers of studies containing quantitative ratings of preparedness relating to each of the Tomorrow's Doctors (2009) outcomes for graduates

Tomorrow's Doctors (2009) outcomes for graduates (with corresponding paragraph number in brackets)	Studies (n)	References of studies
Apply biomedical scientific principles, method and knowledge to medical practice (8)	0	
Apply psychological principles, method and knowledge to medical practice (9)	0	
Apply social science principles, method and knowledge to medical practice (10)	0	
Apply population health and health improvement principles, methods and knowledge to medical practice (11)	0	
Apply scientific methods and approaches to medical research (12)	1	16
Able to carry out a consultation (13)	1	16
Diagnose and manage clinical presentations (14)	1	16
Communicate effectively with patients and colleagues in a medical context (15)	3	12 16 18
Provide immediate care in medical emergencies (16)	6	12 13 16–19
Prescribe drugs safely, effectively and economically (17)	6	12 13 16–19
Carry out practical procedures safely and effectively (18)	2	16 18
Use information effectively in a medical context (19)	2	16 18
Behave according to ethical and legal principles (20)	3	13 16 17
Reflect, learn and teach others (21)	0	
Learn and work effectively within a multi-professional team (22)	4	12 13 17 18
Protect patients and improve care (23)	0	

quantitative data in relation to each of the Tomorrow's Doctors (2009) outcomes for graduates. Some of the Tomorrow's Doctors (2009) outcomes were not covered by any of the studies included in the review. When an individual outcome had been subdivided within a study (such as paragraph 15, 'communicate effectively with patients and colleagues in a medical context',[1] which was divided to provide separate preparedness ratings in relation to patient and interprofessional communication in several studies[13 17 20]), all ratings in relation to that particular outcome were excluded from the review on the basis that the study did not provide a single preparedness rating in relation to a Tomorrow's Doctors (2009) outcome.

Comparing perceived preparedness in acute care with other Tomorrow's Doctors (2009) outcomes

Self-perceptions of preparedness relative to Tomorrow's Doctors (2009) outcomes are summarised in figure 1. Only outcomes that have quantifiable data relating to preparedness available from more than one study are included in figure 1, as it is the trends and comparisons that form the particular focus of this review (seven of the 16 outcomes for graduates listed in table 3 are included in figure 1). The key to the shading in figures 1 and 2 is shown in figure 3 and allows comparison across studies asking subtly different questions or reporting data in different ways. The ratings of self-perceived preparedness shown in figure 1 show that overall graduates consistently consider themselves to be well prepared in communication and team working. The two outcomes in which graduates consistently feel least well prepared are acute care and prescribing, which, together, account for eight of the nine ratings equating to unprepared.

Figure 2 summarises the graduate preparedness ratings given by eight groups of healthcare professionals in four separate studies. Five of the ratings are provided by consultants, and the three others are given by heterogeneous groups of Foundation Year 2s, more senior trainees, consultants and nursing staff. Ratings are generally lower than those given by the graduates themselves, and there are no outcomes in which graduates are consistently perceived to be well prepared. However, similar patterns emerge in relation to the outcomes in which graduates are felt to be poorly prepared, with acute care accounting for three of the five ratings equating to unprepared (obtained from three different studies).

Changes in perceived preparedness since the first publication of Tomorrow's Doctors

The results in figures 1 and 2 are displayed in reverse chronological order using the year of graduation of the newly qualified doctors (not the publication years of the studies). There is some suggestion from figure 1 that self-perceptions of preparedness in relation to practical procedures and team-working have improved since 1993. In contrast, self-perceptions of preparedness in relation to acute care, communication and ethics have remained fairly static, with self-perceived preparedness in prescribing appearing to have declined.

Figure 2 suggests that other healthcare professionals perceive graduate preparedness in communication, ethics, prescribing and practical procedures to have remained relatively static since 1993. In contrast to the self-perceptions data, figure 2 highlights acute care as the one outcome in which graduate preparedness is perceived to be declining, with three of the four most recent ratings equating to unprepared in the generic rating scale.

Concerns relating to preparedness in acute care

Five studies provided information on whether graduates were concerned about preparedness in acute care. The questionnaire used by Goldacre *et al* in their study of the perceived preparedness of all UK graduates in 2002 and 2005 did not include a question relating to acute care, but free text comments highlighted a desire for more 'acute emergency training'.[4]

The qualitative arm of the study by Illing *et al* (2008) collected data using interviews with Foundation doctors at several points during their first year of practice.[17] At the beginning of their first post, 'particular concerns were expressed about taking immediate steps with acutely ill patients, although this was seen as tied to the inescapable change in responsibility which comes with being a doctor, and which cannot be directly prepared for'.[17] Even at the end of their FY1 'being the first doctor to deal with a sick patient was an area of concern', with some graduates feeling that 'having to deal with an acutely unwell patient before senior help arrived had implications for patient safety'.[17]

Evans *et al* investigated the 'three main concerns'[15] of three cohorts of Barts and the London, Queen Mary's School of Medicine and Dentistry graduates, shortly before starting work as doctors. In 2000, only 2% of 48 graduates expressed concern about emergency care of patients. However, around 10% of both graduate cohorts in 2004 raised emergency care as one of their top three concerns about starting work.[15] Only one concern, 'team support', was raised more frequently.

A study by Lempp *et al* involving interviews with 16 graduates from Guy's, King's and St Thomas' School of Medicine in 2001 revealed that 'stress was related to high personal expectations and competence in emergency situations....'[14] Matheson *et al* echoed such findings in their survey evaluation of a four-week preparation for practice course undertaken by 76 graduates of Nottingham medical school in 2006. Four months after starting work, responses to a free text question asking what else

First author, respondent group, year of graduation and sample size	Description of Likert scale used	Tomorrow's Doctors (2009) outcomes for graduates (with paragraph number in brackets)						
		Communication (15)	Acute care (16)	Prescribing (17)	Practical procedures (18)	Information usage (19)	Ethics (20)	Team-working (22)
Tallentire *et al.* FY1s, 2009 (n=19)	4 point scale (1=poor, 4=very good)	Mean 3.00 (SD 0.74)	Mean 2.37 (SD 0.76)	Mean 2.37 (SD 0.76)	Mean 3.11 (SD 0.74)	Mean 2.68 (SD 0.75)	Mean 2.84 (SD 0.76)	
Brown *et al.* FY1s, 2008 (n=200)	5 point scale (5=very competent, 1=not at all competent)	79.1% rated as 4 or 5	56.4% rated as 4 or 5	40.3% rated as 4 or 5				79% rated as 4 or 5
Tallentire *et al.* FY1s, 2008 (n=36)	4 point scale (1=poor, 4=very good)	Mean 3.53 (SD 0.56)	Mean 2.58 (SD 0.87)	Mean 2.69 (SD 0.86)	Mean 3.14 (SD 0.76)	Mean 3.19 (SD 0.58)	Mean 2.78 (SD 0.68)	
Illing *et al.* Glasgow graduates, 2007 (n=131)	5 point scale with upper end indicating preparedness		Mean 3.443 (SD 0.776)	Mean 2.893 (SD 0.963)			Mean 3.153 (SD 0.898)	Mean 4.420 (SD 0.581)
Illing *et al.* Newcastle graduates, 2007 (n=226)	5 point scale with upper end indicating preparedness		Mean 3.411 (SD 0.810)	Mean 2.982 (SD 0.863)			Mean 3.231 (SD 0.866)	Mean 4.280 (SD 0.646)
Illing *et al.* Warwick graduates, 2007 (n=123)	5 point scale with upper end indicating preparedness		Mean 3.390 (SD 0.685)	Mean 2.983 (SD 0.836)			Mean 3.174 (SD 0.782)	Mean 4.279 (SD 0.695)
Tallentire *et al.* FY1s, 2007 (n=52)	4 point scale (1=poor, 4=very good)	Mean 3.13 (SD 0.68)	Mean 2.52 (SD 0.70)	Mean 2.33 (SD 0.79)	Mean 2.75 (SD 0.82)	Mean 2.92 (SD 0.76)	Mean 2.82 (SD 0.74)	
Brown *et al.* FY2s, 2007 (n=95)	5 point scale (5=very competent, 1=not at all competent)	90.9% rated as 4 or 5	80.3% rated as 4 or 5	54.6% rated as 4 or 5				90.8% rated as 4 or 5
Berridge *et al.* FY1s pre-course, 2005 (n=50)	5 point scale (1=confident, 5=not confident)		Mean 3.26 (median 3, IQR 3-4)	Mean 3.26 (median 3, IQR 3-4)				
Berridge *et al.* FY1s one month post-course, 2005 (n=35)	5 point scale (1=confident, 5=not confident)		Mean 2.46 (median 3, IQR 2-3)	Mean 2.40 (median 2, IQR 2-3)				
Wall *et al.* PRHOs, 2003 (n=193)	6 point scale (1= strongly disagree I am prepared, 6=strongly agree I am prepared)	Mean 4.8834	Mean 4.0337	Mean 4.1839	Mean 4.4767	Mean 4.4508		Mean 4.9922
Clack Graduates, 1985-86 and 1989-90 (n=371)	Course content rated as too much, about right or too little. Attributes rated as yes, partially or no.		57.3% felt they had 'not enough' training	67.6% felt there was 'too little' course time			62.8% felt there had been 'too little' course time	64.4% felt they had the ability to work in a team

Figure 1 Self-perceptions of preparedness relative to Tomorrow's Doctors (2009) outcomes. FY, Foundation Year; PRHO, Pre-registration House Officer.

should be included in the course highlighted a desire to learn 'how to respond to on-call emergencies'[11] and 'what to do with a sick patient'.[11]

Only one of the included studies made direct reference to concerns of other healthcare professionals in relation to acute care. Tallentire *et al* thematically analysed free text responses from 47 FY1s and 109 educational supervisors and noted that 'identification and management of acutely unwell patients appeared to be a source of concern for both educational supervisors and FY1s'.[16]

DISCUSSION

This review provides an overview of current research on perceived preparedness in acute care and an opportunity to reflect on how it compares to perceived preparedness in other domains, using the framework provided by Tomorrow's Doctors (2009). The results suggest that acute care and prescribing are the outcomes in which graduates throughout the UK perceive themselves to be least well prepared for professional practice. Senior colleagues and other healthcare professionals working alongside newly qualified doctors perceive them to be less prepared in acute care than in any of the other outcomes. In addition, perceived preparedness in acute care appears to have declined since the first publication of Tomorrow's Doctors in 1993. Studies of preparedness for practice which have provided the option of a free text response have consistently shown acute care to be an area of concern for UK graduates.

The preparedness ratings given by newly qualified doctors (figure 1) are frequently higher than those given by their professional colleagues (figure 2) across the majority of Tomorrow's Doctors (2009) outcomes. This disparity has been noted elsewhere,[16 18 21] and while various authors have offered explanations for the differences, studies exploring this specific issue are lacking. This review highlights that prescribing appears to be an exception, with preparedness ratings given by FY1s consistently lower than those given by healthcare colleagues. A similar review focusing on preparedness in prescribing would help to establish whether this observation is merely an artificial product of the studies investigating preparedness in both acute care and prescribing.

The results presented within this paper may be of little surprise to those involved in either undergraduate or post-graduate medical training. The care of acutely unwell patients is complex, involving a myriad of technical and non-technical skills in time-pressured situations and increasingly litigious environments. It is therefore unlikely that new graduates will ever feel completely at ease with acute care; perhaps it is preferable from a patient safety perspective that they do not, prompting them to call for senior help more readily. It is, however, of concern that graduate preparedness in acute care, as perceived by their professional colleagues, compares so unfavourably with preparedness in other outcomes and appears to be trending downwards. All UK medical schools would claim that their graduates can assess acutely unwell patients and instigate generic resuscitative measures, but senior doctors and other healthcare professionals have rated FY1s as unprepared to do so in several recent studies. In their paper published 5 years ago, Wall *et al* concluded by asking, 'have the

First author, respondent group, year of graduation and sample size	Description of Likert scale used	Tomorrow's Doctors (2009) outcomes for graduates (with paragraph number in brackets)						
		Communication (15)	Acute care (16)	Prescribing (17)	Practical procedures (18)	Information usage (19)	Ethics (20)	Team-working (22)
Tallentire *et al.* Consultants, 2009 (n=24)	4 point scale (1=poor, 4=very good)	Mean 2.58 (SD 0.65)	Mean 2.05 (SD 0.72)	Mean 2.22 (SD 0.90)	Mean 2.10 (SD 0.88)	Mean 2.88 (SD 0.74)	Mean 2.65 (SD 0.83)	
Brown *et al.* Consultants, 2008 (n=345)	5 point scale (5=very competent, 1=not at all competent)	63.9% rated FY1s as 4 or 5	30.7% rated FY1s as 4 or 5	39.0% rated FY1s as 4 or 5				46.1% rated FY1s as 4 or 5
Tallentire *et al.* Consultants, 2008 (n=16)	4 point scale (1=poor, 4=very good)	Mean 2.81 (SD 0.75)	Mean 1.86 (SD 0.53)	Mean 2.13 (SD 1.15)	Mean 2.00 (SD 0.68)	Mean 3.06 (SD 0.57)	Mean 2.86 (SD 0.77)	
Illing *et al.* Glasgow team members, 2007 (n=25)	Rating of prepared, unprepared or don't know		16% felt graduates were prepared	72% felt graduates were prepared				80% felt graduates were prepared
Illing *et al.* Newcastle team members, 2007 (n=22)	Rating of prepared, unprepared or don't know		57% felt graduates were prepared	67% felt graduates were prepared				90% felt graduates were prepared
Illing *et al.* Warwick team members, 2007 (n=16)	Rating of prepared, unprepared or don't know		60% felt graduates were prepared	73% felt graduates were prepared				87% felt graduates were prepared
Tallentire *et al.* Consultants, 2007 (n=45)	4 point scale (1=poor, 4=very good)	Mean 2.71 (SD 0.66)	Mean 2.20 (SD 0.68)	Mean 2.09 (SD 0.79)	Mean 2.09 (SD 0.78)	Mean 2.98 (SD 0.74)	Mean 2.48 (SD 0.71)	
Wall *et al.* Consultants, 2003 (n=212)	6 point scale (1= strongly disagree PRHOs are prepared, 6= strongly agree PRHOs are prepared)	Mean 4.3986	Mean 3.9552	Mean 3.8066	Mean 4.3703	Mean 4.6203		Mean 4.5778

Figure 2 Other healthcare professionals' perceptions of graduate preparedness relative to Tomorrow's Doctors (2009) outcomes. FY, Foundation Year; PRHO, Pre-registration House Officer.

undergraduate curriculum reforms concentrated too much on communication skills to the detriment of basic clinical competencies, such as treatment, prescribing and managing emergencies?'[18] The studies presented in this review go some way to providing an answer.

Limitations

By including only studies which contained questions or themes that could be mapped directly onto the outcomes detailed in Tomorrow's Doctors (2009), it is possible that this review has excluded additional studies containing relevant information, particularly studies that have subdivided outcomes. In addition, the relatively small number of studies included in the review means that only tentative suggestions can be made in relation to trends. Many of the included studies were undertaken by employees of UK medical schools investigating the preparedness of graduates from their own institutions. It is therefore likely that a variety of non-financial internal factors such as departmental pressure to publish, rarely disclosed as competing interests, exerted undue influence on the authors of such studies.[22]

However, the main limitation of this review is the use of a subjective outcome measure; perceived preparedness cannot be assumed to correlate with actual preparedness. Self-assessment is important, as the self-regulating nature of the medical profession within the UK relies on the abilities of doctors to identify their own learning needs. However, self-assessment as general and unguided reflection on one's performance is

Figure 3 Key to shading in figures 1 and 2. FY, foundation year.

Overall review rating	Equivalent rating in studies
Very well prepared	At least 90% of respondents feel confident / prepared (or consider their FY1 colleagues to be) or mean score equal to or above 'very well prepared' or equivalent on Likert scale
Well prepared	At least 75% but fewer than 90% of respondents feel confident / prepared (or consider their FY1 colleagues to be) or mean score equal to or above 'well prepared' but below 'very well prepared' or equivalent on Likert scale
Prepared	At least 50% but fewer than 75% of respondents feel confident / prepared (or consider their FY1 colleagues to be) or mean score equal to or above 'adequately prepared' but below 'well prepared' or equivalent on Likert scale
Not prepared	Fewer than 50% of respondents feel confident / prepared (or consider their FY1 colleagues to be) or mean score below 'adequately prepared' or equivalent on Likert scale

unreliable.[23] Despite the high face validity of self-preparedness ratings, a systematic review comparing doctor self-assessment ratings against independent assessment ratings found that only seven out of 20 studies demonstrated a positive correlation.[24]

Implications for practice

This review has identified several areas requiring further work. Studies that quantify perceived preparedness of graduates across the whole range of Tomorrow's Doctors (2009) outcomes are required, in order that medical schools can focus curriculum developments on the areas in which new graduates and their colleagues have concerns. A more detailed understanding of the specific challenges faced by newly qualified doctors in the context of acute care is required in order that tailored educational interventions can be developed.

Simulation training is rapidly gaining popularity as a means of exposing trainees of all levels to challenging clinical scenarios without risk of harm to patients. While simulation training is expensive in terms of faculty and resources, medical schools may need to consider running such courses throughout the undergraduate curriculum in order to adequately prepare their students for practice. Other studies have called for training strategies which 'sufficiently mimic the real clinical environment, involving multiple demands on time, the need to prioritise and the responsibility of dealing with acute cases'.[17] The General Medical Council mandated Student Assistantship 'a period during which a student acts as assistant to a junior doctor, with defined duties under appropriate supervision',[1] is currently being integrated into all UK medical school curricula. It will be interesting to explore whether students gain experience of managing acutely unwell patients during their assistantships and to monitor perceived preparedness in acute care, and more generally, during this period.

CONCLUSION

The literature included in this review suggests that graduates and their clinical colleagues perceive preparedness in acute care to lag behind preparedness ratings mapped onto most other Tomorrow's Doctors (2009) outcomes. The results of this study suggest that recent changes to UK undergraduate training, while improving preparedness in some areas, may have neglected acute care skills. It is well recognised that perceived preparedness is a poor surrogate for actual preparedness. However, whether accurate or not, a perceived lack of preparedness in acute care exacerbates the stress and anxiety experienced by newly qualified doctors, which, in turn, impacts behaviour in complex ways.[25] Improving perceived preparedness in acute care, along with actual preparedness and the accessibility of senior supervision, is thus an important component of enhancing patient care and alleviating some of the inevitable anxiety related to the transition between undergraduate training and postgraduate practice.

Main messages

- Graduates from UK medical schools perceive themselves to be less well prepared in acute care and prescribing than other Tomorrow's Doctors (2009) outcomes
- Senior doctors and other healthcare colleagues perceive newly qualified doctors to be less prepared in acute care than in any other Tomorrow Doctors (2009) outcome
- Preparedness in acute care may have declined since the first publication of Tomorrow's Doctors and is an area of concern for UK graduates

Current research questions

- What are the specific challenges faced by newly qualified doctors in acute care contexts?
- How can postgraduate training evolve to better support FY1s and help them feel prepared for all aspects of their work?
- Aside from acute care, which other Tomorrow's Doctors (2009) outcomes require renewed emphasis in undergraduate curricula in order that graduates are optimally prepared for postgraduate practice?

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Contributors VRT designed the study, performed the literature searches, undertook data extraction and quality scoring, and drafted the manuscript. SES performed data extraction and quality scoring, and assisted in drafting the manuscript. JS and HSC advised on all stages of the study, and all four authors reviewed the final manuscript prior to submission.

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Understanding the behaviour of newly qualified doctors in acute care contexts

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CONTEXT A particularly onerous aspect of the transition from medical student to practising doctor concerns the necessity to be able to rapidly identify acutely unwell patients and initiate appropriate resuscitation. These are skills in which many graduates feel poorly prepared and are considered by some to be best learned on the job. This constructivist study investigated the factors that influence the behaviour of junior doctors in this context and initiated the development of a framework that promotes understanding of this important area.

METHODS Focus groups involving 36 clinicians with a variety of clinical experience were conducted and analysed using a qualitative, grounded theory approach. The complex relationships between emergent themes guided the development of a framework that was refined and validated by further interviews with participants.

RESULTS Six main themes, grouped under three broad headings, emerged from the data: 'transferring knowledge into practice' and 'decision making and uncertainty' (cognitive challenges); 'acts and omissions' and 'identity and expectations' (roles and responsibilities), and, finally, 'the medical hierarchy' and 'performing under stress' (environmental factors). The framework presented within this paper illustrates the complex relationships between these factors.

CONCLUSIONS Although the potential of metacognitive strategies to reduce medical error is acknowledged, the framework promotes looking beyond the individual to consider the contributions to patient safety of identity issues, role uncertainty and the hierarchical clinical environment. A more distributed approach to situation awareness may help junior doctors to better tolerate complexity and uncertainty. The efficacy of simulation as an educational strategy may be improved by finding ways to recreate the hierarchical and stressful environment in which junior doctors practise. Junior doctors should be aware of the impact of affect and emotion on behaviour, and clinical supervisors should strive to ensure that roles and responsibilities are explicitly discussed.

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INTRODUCTION

Rapid identification and timely resuscitation of acutely unwell patients within a hospital environment saves lives and reduces intensive care admissions.[1,2] Patient safety initiatives throughout the developed world have recognised the potential to reduce mortality by focusing on the delivery of care to this high-risk group.[3,4] More than in any other cohort, the survival of critically ill patients depends on care that is reliable, timely and error-free.[4] Within the hospital environment, the first responders to such patients are often junior doctors and therefore deepened understanding of their behaviour is pivotal to improving patient outcomes.

Throughout the world, the transition from medical student to newly qualified doctor is characterised by a plethora of new challenges. For many, a perceived lack of preparedness for the role of doctor makes the transition stressful and difficult.[5–8] Previous research has suggested that the care of acutely unwell patients is an area in which many medical graduates feel poorly prepared.[7,9–12] Much of the research focus, however, has been on quantifying preparedness in a single facet of acute care[13–17] or on the evaluation of courses designed to improve acute care skills before or shortly after the graduate commences work as a doctor.[18–22] To date, none of the work published has attempted to synthesise the various influences on behaviour in an acute care context into a framework that illustrates the complexities of this challenge.

A review of the 'preparedness for practice' research makes it clear that there is discrepancy between the perceptions of newly qualified doctors and those of their senior colleagues in relation to graduates' preparedness in a variety of domains.[12,23,24] As studies comparing perceptions of these groups in relation to acute care are lacking, this study has incorporated the exploration of both perspectives to better illuminate the challenges faced by newly qualified doctors in this specific context.

Research question

This constructivist study aimed to address the gap in the literature by answering the question: 'What factors affect newly qualified doctors' behaviour in caring for acutely unwell patients?' In order to meet this aim, the authors set out to:

- explore the salient factors identified by newly qualified doctors and their senior colleagues;
- compare perceptions of these factors between the two groups, and
- use the emerging themes to develop a framework that conceptualises the influences on newly qualified doctors' behaviour in the context of caring for acutely unwell patients.

METHODS

Setting

The study was conducted in National Health Service (NHS) Lothian in Scotland. Undergraduate medical training in the UK consists of several years of clinical attachments, including exposure to acute specialties such as emergency medicine and acute medicine. Following graduation, students proceed to Foundation training, which involves two years of clinical rotations (FY1 and FY2). Approximately half of the FY1 and FY2 doctors working in Lothian have undergone training at the University of Edinburgh and the other half have migrated from a wide range of undergraduate medical courses. In NHS Lothian, FY1 doctors do not work within emergency departments and this study is therefore restricted to the care of acutely unwell ward patients.

Design

The study was conducted using focus groups in combination with grounded theory methodology. In contrast to other forms of interview, focus groups allow the discussion of complex topics and emphasise the interactions between research participants to generate data and explore why participants think the way they do.[25,26] Grounded theory originated from the work of Glaser and Strauss[27] and describes an inductive method that aims to advance knowledge through the generation of new theories that are 'grounded' in a systematic analysis of the data.[27] It is therefore suited to studies that address poorly understood topics for which there is a dearth of existing theory.[28] This study employs the constructivist approach to grounded theory methodology first developed by Charmaz.[29,30] In contrast to Glaser and Strauss,[27] who asserted that theories are 'discovered' from the data, Charmaz[29] argues that grounded theories are 'constructed'. She holds the view that the interplay between researcher and participants is central to the construction of theory, which itself represents an 'interpretive portrayal of the studied world'[30] and not an exact replica of it. The choice of study

design was guided by the research question and the epistemological stance of the authors.

Sampling

A theoretical sampling model was used to seek volunteers via e-mail from three separate groups, including: consultant and specialist registrar (SpR) grade doctors ('seniors'); FY2 doctors, and FY1 doctors.[31] The e-mail outlined the purpose of the study and indicated the activity and likely time commitment involved. All senior doctors were required to be actively involved in the supervision of Foundation doctors and to have regular clinical exposure to acutely unwell patients. The categorisation of doctors into three groups produced cohorts of individuals with similar clinical experience, whom the researchers felt would have differing views in relation to the research question.[32] The groupings meant that peer group perspectives could be elicited, analysed individually and compared. Ethical approval was waived by the South East Scotland Research Ethics Service and written consent for data collection and the publication of anonymised results was obtained from all participants.

Data collection

Between September and December 2009, a total of six focus groups were undertaken, two with each group of doctors. Each focus group had between four and eight participants and was facilitated by a single researcher (VRT). Group sessions lasted 70–95 minutes and, with the consent of all participants, were audio-recorded.

To initiate discussion, participants were asked the following open questions:

- What factors do you feel affect newly qualified doctors' behaviour when caring for acutely unwell patients?
- How do newly qualified doctors cope when faced with an acutely unwell patient?
- In what ways does undergraduate training prepare the newly qualified doctor to deliver care to an acutely unwell patient?

As the session developed, inconsistencies among participant responses were highlighted by the facilitator and used as a basis for individuals to clarify the reasons why they held certain views or beliefs.[25,33] Participants were encouraged to exchange ideas and anecdotes and to comment on one another's experiences and views.[34] Field notes were taken by the facilitator during and immediately following the group discussions.

Analysis

The focus group recordings were transcribed verbatim and analysis was conducted using the audio-recordings, transcripts and field notes. Coding and categorisation were undertaken using NVivo Version 8 (QSR International Pty Ltd, Doncaster, Vic, Australia), which facilitates the development of a cross-group thematic framework whilst allowing the continual checking of the contextual validity of individual comments or excerpts of discussion.[35] Analysis of early focus groups commenced in parallel with continued data collection in order to allow for the deeper exploration of emerging themes with subsequent participants.[30] As emergent themes were identified, particular attention was paid to affording comparisons between groups as well as the process and pattern of discussion to highlight non-consensus or contradictory views that may not be represented in group summaries.[33,36] The principal researcher (VRT) assigned codes to emerging areas of interest, continually renaming, reshuffling and redefining the codes to build a thematic grid.[28] A second researcher (SES) re-coded three of the six focus group transcripts. Differences were subsequently discussed, new themes identified and theme names and descriptions refined until agreement on the coding system was reached.[30] When categorisation was complete, axial coding was performed to elicit overarching themes and promote the exploration of relationships between emergent themes.

Validation

During the process of data analysis, the researchers gradually developed and refined a conceptual framework incorporating the emergent themes and the relationships among them. Following the development of an initial framework, meetings were arranged with nine of the study participants to discuss the associations of emergent themes and compare the researchers' interpretation with that of participants.[36] Participants were selected for the validation exercise on the basis of diversity of opinion expressed at the focus groups. Although the researchers hoped that the process of data analysis had allowed them to reach a higher level of abstraction than the participants, the validation process helped to ensure that the themes and associations resonated with the participants and had not been recast into 'a lifeless language that better fits our academic and bureaucratic worlds than those of our participants'.[30] Detailed field notes were taken and interviewees were encouraged to sketch new ideas and annotate the evolving framework. Several suggestions of unexplored associations prompted the researchers to return to the data for further analysis. If

no evidence of an association was found in the transcribed focus group discussions, the new data generated from respondent validation were considered for incorporation into the framework.[36]

RESULTS

A total of 36 doctors participated in six focus groups. They included 13 'seniors', 12 FY2 doctors and 11 FY1 doctors. The final two focus groups (one with seniors and one with FY2 doctors) yielded no new themes.[30,37] Responses from the FY1 and FY2 focus groups showed no apparent differences and are therefore considered together as representing the responses of 'juniors'. The developing framework was discussed with nine of the study participants, who included four seniors and five juniors. Three main themes emerged from the focus group data: 'cognitive challenges'; 'roles and responsibilities', and 'environmental factors'. The differences between juniors and seniors in perception and emphasis in relation to each of the themes are highlighted and subsequently discussed.

'Cognitive challenges' refers to the thought processes involved in the clinical assessment, investigation and management of the patient. 'Roles and responsibilities' refers to the individual's place within the organisation and the expectations (of self and others) that accompany that position. 'Environmental factors' refers to the context within which the individual is working, in terms of both specific situational factors and organisational structure.

Cognitive challenges

Transferring knowledge into practice

Using a variety of different examples, both the junior and senior doctors highlighted the difficulties associated with translating theoretical knowledge into practice. The importance of a structured patient assessment was repeatedly emphasised by seniors and the apparent lack of structure was often attributed to lack of rehearsal:

'They kind of know the A to E structure [airway, breathing, circulation, disability, exposure/everything else] to talk about it, but they actually don't apply it. They get the concept; they just haven't practised it enough.' (Senior 11)

'That's why scenario training and rehearsal is hugely helpful to actually put them through their paces. It's one thing to have an algorithm and learn it from a book... it's a completely different thing to put it into practice.' (Senior 9)

The juniors also felt that translating theoretical knowledge into practice, particularly in relation to applying a structured approach to patient assessment, presented a challenge. They stressed that when they were asked about the care of an acutely unwell patient, in either an examination or an informal discussion, they were able to provide a structured answer demonstrating a logical sequence of assessment and appropriate initial management. Although they acknowledged that rehearsal may help to 'bridge the gap', they also felt that they often knew *what* to do in terms of both assessment and management, but did not know *how* to do it:

'ABC is like "mirrors, signal, manoeuvre", at driving school. Any 4-year-old can repeat the words "mirror, signal, manoeuvre", but it's very different actually doing it... We had so few opportunities to actually practise it.' (Junior 3)

'Yeah, medical school doesn't really prepare you for being an FY1, it's completely different you know... I knew what to do, I just didn't know how to actually do it; I wasn't prepared in a practical sense at all.' (Junior 6)

'Exactly! Like the bradycardia I saw the other day... I knew as a medical student that I needed to give atropine but I had never seen it, never drawn it up, never had to actually give it, so that knowledge isn't in a form you can use it.' (Junior 3)

Decision making and uncertainty

Acutely unwell patients often require empirical resuscitative measures to be instigated concurrently with investigations that aim to characterise the nature of the illness and ultimately reach a definitive diagnosis. The seniors found what they called the 'history, examination, then do something' attitude of the juniors a source of great frustration, whereas the juniors frequently commented on how unfamiliar and uncomfortable it felt to initiate treatment without knowing the patient's diagnosis. They also described a process of trying to 'guess' the diagnosis when only a cursory assessment had been made in order to try to work out which treatment was appropriate. Once they had thought of a diagnosis, they often found themselves fixated on it, even when additional examination findings and investigation results were inconsistent with their hypothesis:

'It is a totally new concept to have to run without a diagnosis. Once you have a diagnosis in your head it

is impossible to move away from that and consider other things, you just continue, you know, down the same path.' (Junior 11)

Several juniors described employing distraction techniques, such as focusing on the completion of a specific task, in order to avoid facing difficult decisions in the context of diagnostic uncertainty:

'...well, it makes you feel like you are doing something. If you are rushing around finding a Venflon [intravenous cannula] and putting it in, then you can't really focus on the fact that you don't know what's going on, or the patient can't breathe. It's the urge to actually do something in the acute situations, so we do the things, well the things that we know how to do and don't really need to think about.' (Junior 23)

Roles and responsibilities

Acts and omissions

The reluctance to make decisions was closely associated with the belief that causing harm to the patient by making an egregious error was in some way worse than allowing harm to happen by omitting an action or failing to initiate treatment:

'You suddenly realise that you could kill someone. You could make them better, which is obviously what you are trying to do, but you are afraid that if you do something wrong then you could kill them faster than if you'd done nothing.' (Junior 5)

'Yeah, I think that is a lot of what underlies a lot of the time wasting in an acute situation. People are afraid of doing something that will have a bad outcome so they just write the notes or put in another Venflon.' (Junior 10)

The overwhelming desire to 'do no harm' appeared to stem from undergraduate training and the emphasis placed on being aware of one's own limitations:

'The teaching sort of instils behaviours in doctors... at the moment it focuses on "don't do anything that you're not sure of, don't ever be out of your depth", but perhaps we need to teach that in some situations you do need to act, and take responsibility, and messing up is better than doing nothing sometimes.' (Junior 15)

Identity and expectations

The juniors described some uncertainty about their new roles, often precipitated by a disparity between the level of responsibility imposed upon them and that which they felt happy to accept. Although they considered themselves to be responsible solely for ensuring that a patient survived until senior help arrived, they also felt that they were abdicating responsibility if they did not attempt to assess, investigate, diagnose and treat a patient before calling for help. Juniors often judged their behaviour against their expectations of themselves and what they believed a doctor should be able to do:

'You don't want to phone for help and them say, "What have you done?" and you have to say, "Nothing." Because that would make you feel useless. And you feel like: "I'm a doctor now, I should be able to at least start to manage a situation."' (Junior 7)

As well as judging themselves against their own expectations, juniors also judged their behaviour against their perceptions of the expectations of senior colleagues. They described being reluctant to call for help if they hadn't undertaken simple investigations, as they feared they might fall short of their senior colleagues' expectations:

'Sometimes as an FY1 you worry that someone won't be happy that you've called them, and got them to come. You think: "Maybe I should just do an ABG [arterial blood gas]; they won't be happy if I haven't done that." And you think you have to do all these things to prove that you have tried, when actually you should just phone.' (Junior 9)

The seniors recognised the reluctance of their junior colleagues to call for help, which they attributed to a variety of different factors, including role-modelling, concern about being compared unfavourably with predecessors and, paradoxically, a desire to exceed senior colleagues' expectations:

'We're not very good at asking each other for help, are we? ...as a consultant I'm not good at asking for help; I've been in the resus [resuscitation] room and thought I could really do with a help and hadn't realised it until really you've been with the patient too long.' (Senior 6)

'There's this prevailing attitude that FY1s are up against; that trainees aren't as good now as they were in the past. That's tough for them. Perhaps that is why they seek out hard evidence before calling for help...' (Senior 3)

'My feeling is that after the medical school process, it's very difficult to get them out of the mentality that

they are there to perform, and shine, on their own.' (Senior 4)

Environmental factors

The medical hierarchy

The language used by juniors when referring to their senior colleagues was characterised by military analogies, with references to 'battle', being 'foot soldiers' who are 'shot down', require 'armour' for protection and 'take orders':

'One of the problems is that when people call early for help, sometimes they get blown out for doing it, because the person on the other end wants to know lots of information that you don't have... so people shy away from making the call until they feel that they have enough armour, in the form of knowledge that is going to be demanded from them, to come out of the call unscathed.' (Junior 2)

'I didn't quite realise until I started how hierarchical medicine is... as soon as you are in the system as a junior, you realise that actually it hasn't really changed that much. We are the foot soldiers. And you jump when people say jump. And you don't talk back. And you don't question things. So speaking in a forceful manner in an acute situation to a "superior officer" goes against the grain and you know that you are going to be in big trouble if you do it.' (Junior 11)

Although the seniors did acknowledge the presence of a hierarchy, they felt that it was confined to surgical specialties, whereas the juniors described it as a barrier to seeking help in all contexts.

Performing under stress

Dealing with acutely unwell patients is one of the most demanding facets of a junior doctor's workload because it involves situations characterised by time pressure, high-stakes outcomes, heavy information load and dynamic conditions. Juniors frequently described feeling overwhelmed and even paralysed by the stress of having to manage an acutely unwell patient and articulated the impact of stress on their behaviour:

'When you start as an FY1 and someone gets unwell, you think they are going to die in seconds. And so you panic. But very rarely is that actually the case. You have got time to think about what you are doing. You have more than 10 seconds; you have got a little longer than you think.' (Junior 1)

'We need better referring skills... in acute situations that is really difficult.' (Junior 5)

'...the stress of that situation, that's what makes it hard... You know what you need to say, but the reality is that you panic.' (Junior 2)

Links to the cognitive challenges described earlier became increasingly evident as junior doctors described how the presence of diagnostic uncertainty exacerbated stress, which, in turn, impacted on their decision-making ability:

'I met personal brick walls very quickly at the beginning, of not knowing what to do next, because panic would set in.' (Junior 7)

Senior doctors appreciated that juniors found acute situations stressful, but seemed to regard the emotional response as a transient, restrictive state rather than the pervasive, debilitating state described by their junior colleagues:

'We are never going to produce an FY1 who can step back, take it all in and calmly consider the situation... the best that we can get is to equip them to go onto "automatic pilot" in an efficient way... it's almost teaching them to "tread water" until their anxiety subsides to a level where they can think again.' (Senior 4)

In addition, seniors tended to move away from discussing the emotions of the acute situation, and favoured discussing the role of subsequent 'debriefing':

'We are bad ... at sitting down afterwards and talking about it. I guess it is quite traumatic for the FY1s. There simply isn't enough time; but I suppose it doesn't even need to take very long.' (Senior 2)

Construction of a conceptual framework

During the iterative process of data analysis and subsequent respondent validation, it became increasingly evident that the three themes, although they are presented here individually and sequentially, interact and overlap in complex ways. This constant interplay between the themes is an essential component of the framework shown in Fig. 1. (colour version of this figure is available online as supporting information; Fig. S1). The framework includes only the relationships that can be justified by the data. Each association is denoted by an arrow and further detail and illustra-

tive quotes are shown in the adjacent text boxes. The unlabelled arrows represent the direct influence of the six themes described above on the behaviour of newly qualified doctors. The emphasis on behaviour, as opposed to attitudes, knowledge or any other facet of competence or professionalism, is based on the assumption that it is what a doctor does – as opposed to what he or she knows, thinks or feels – that primarily impacts on patient outcome.

DISCUSSION

The conceptual framework presented within this paper is an interpretation of the data *produced* by, as opposed to discovered from, the interactions between the researchers and participants.[29] The concept of an objective reality (positivism) has been rejected by the authors and in its place lies a belief that meaning is context-specific. Since its inception in the 1960s, grounded theory methodology has undergone a process of evolution described as a 'methodological spiral',[38] which has mirrored the epistemological trends of education research more generally. Despite its rising popularity, Glaser[39] continues to dispute the existence of constructivist grounded theory with arguments firmly situated within a post-positivist framework that maintain that participant interpretation (rather than mutual interpretation) is of paramount importance.

The framework presented within this paper fulfils Charmaz's definition of theory;[30] it is constructed from themes that are separated from, but grounded in, the data and that relate to one another at a theoretical level. In producing the framework, the authors do not seek to *explain* or *predict* using linear reasoning (as do positivist theories), but rather to *understand* complexity by emphasising connections and relationships.[30] Critics of grounded theory have argued that it merely leads to generic, decontextualised explanations.[40] Although such criticism may be true of objectivist grounded theory (which strives to discover a generalisable explanation), constructivist grounded theory is inextricably linked to its context

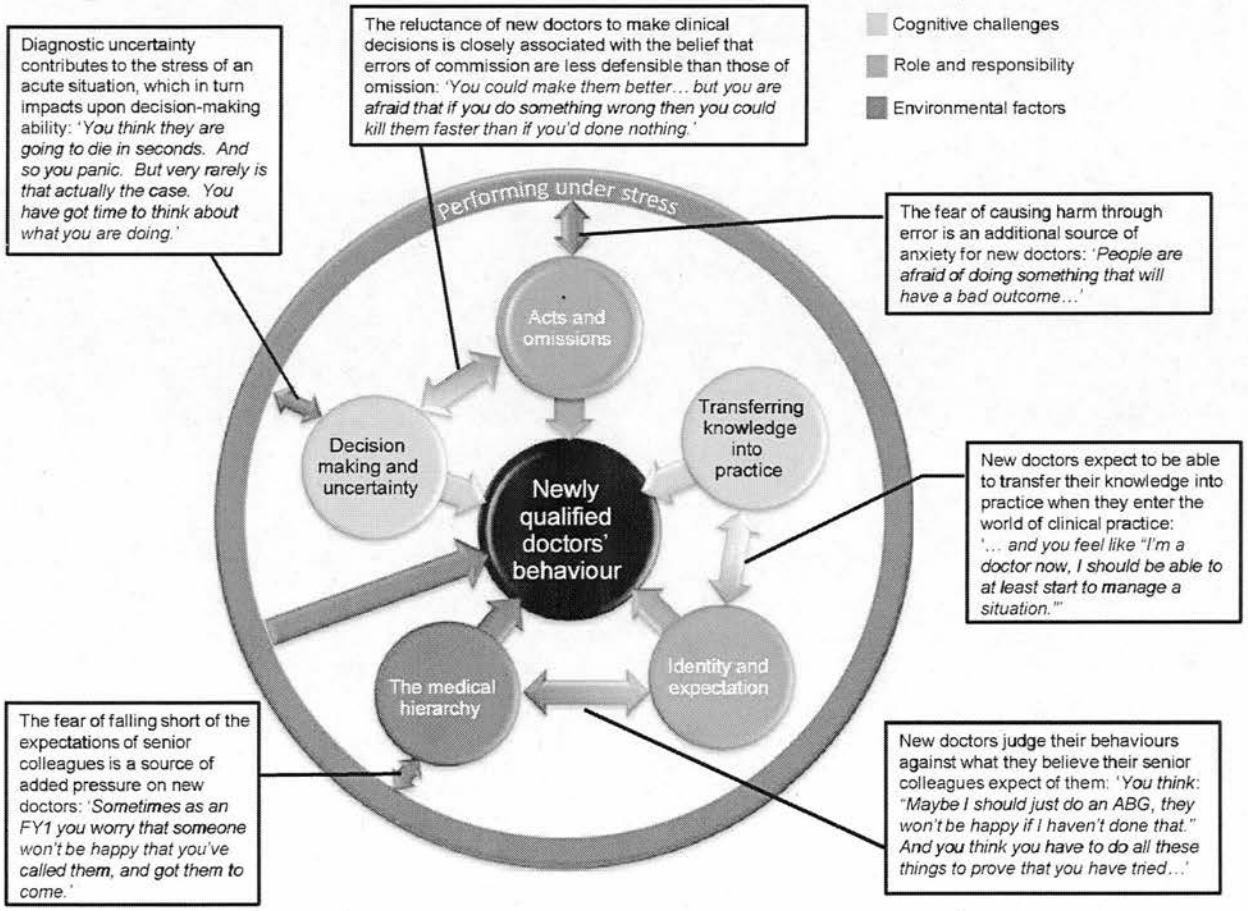

Figure 1 A conceptual framework illustrating the major influences, and their inter-relationships, on the behaviour of newly qualified doctors caring for acutely unwell patients

because it has been co-produced by the researcher and his or her participants.

The three themes of 'cognitive challenges', 'roles and responsibilities' and 'environmental factors' may be explored with reference to contemporary debate surrounding dominant learning theories and trends within medical education. The theme of 'cognitive challenges' resonates with recent interest in cognitive and metacognitive strategies and their potential to reduce medical error[41,42] and improve patient outcomes.[43] Such theories might be incorporated into medical and nursing curricula by focusing on improving situation awareness. The conventional model of situation awareness, first described in military and aviation settings but subsequently adapted for anaesthesia,[44] is based on the internalised processes of an individual and his or her assimilation of all available information. Good situation awareness, along with adequate knowledge, is recognised as an essential precursor to safe decision making, particularly in time-pressured and high-stakes situations.[45]

Although the exciting potential of metacognitive strategies to modify flawed clinical reasoning and reduce medical error is acknowledged, recent medical education research compels us to look beyond the individual. The emergence of the theme 'roles and responsibilities' in this study supports others who have concluded that much of the anxiety characterising the transition from medical student to doctor can be attributed to feelings of being forced to take responsibility and the uncertainties of a new role.[6,7] Other recent work has highlighted the importance of identity issues and organisational factors in the origins of trainees' desires to demonstrate clinical independence and avoid seeking help.[46] Situated learning models conceptualise learning as not only the accumulation of knowledge and skills, but also as the development of a new identity as a member of a particular 'community of practice'.[47] In their desire to embrace the identity of a master practitioner, junior doctors may feel compelled to assess and manage acutely unwell patients alone, as they have seen others do[46] ('...as a consultant I'm not good at asking for help'). A limitation of Lave and Wenger's theory as applied to this particular context is that it speaks only of apprenticeship and communities of practice (characterised by a 'shared repertoire') in which learners progress gradually from the status of novice to that of expert or 'master'.[47,48] In contrast to this gradual transition of responsibility, however, the world of hospital medicine can be characterised by a rigid hierarchy and frequently populated by obsequious juniors who pay unquestioning deference to authority. Such environments provide rich breeding grounds for error, particularly when combined with the effects of fatigue, time pressure and stress on cognition deployment (a variant of the speed/accuracy trade-off from the discipline of human factors).[45,49,50] The challenge in hospital medicine is to consider how junior doctors can be encouraged to develop their professional identities by the gradual acquisition of responsibility, whilst at the same time improving patient safety by promoting the questioning of decisions and procedures that the more 'peripheral' learners observe being undertaken by their senior colleagues.

The emergence of 'environmental factors' as the third theme and the interplay between the themes in the framework emphasise the complex reality of clinical medicine. The results of this study highlight both the detrimental effects of stress on cognition[50] ('not knowing what to do next, because panic would set in') and the human tendency to focus attention so closely on one aspect of a situation that other cues are not noticed[45] ('...it is impossible to move away from that and consider other things'). Similar demonstrations of the fallibility of human perceptual and memory systems have led to a call for medicine and medical training to adopt more distributed approaches to situation awareness.[51] A distributed cognition approach to medical decision making recognises that a junior doctor's decisions do not occur in isolation but are transformed by the dynamic interaction between the junior doctor, the patient, other members of the health care team and additional external artefacts.[52] The data tell us, however, that junior doctors' decisions and behaviours are also influenced by the prevailing culture of the organisation and the juniors' perceptions of the hierarchy within which they work. In medical practice there remains a misconception, by juniors and seniors alike, that calling for help is synonymous with failing to cope. Junior doctors' descriptions of wrestling with both the anxiety of being directly responsible for patient harm and the dread of being reprimanded by a senior colleague are sobering. Newly qualified doctors enter into a community of practice that continues to confuse error and blameless failure, having received little guidance on how to respond emotionally to either.[49]

Limitations of the study

This study incorporates different perspectives gleaned from individuals involved in the delivery of acute care in order to develop a conceptual framework that is grounded in empirical data and supported by work within and outwith the domain of medical education.

The incorporation of doctors from a variety of medical schools means that the perspective is broader than that obtained from a single institution. The study is, however, limited by several methodological factors. Any study that employs volunteers risks sampling those with particularly strong views or a specific personality type, factors that are also likely to affect these individuals' care of acutely unwell patients. In addition, the relatively small sample size limits claims of theoretical saturation.[37] Our practice of separating participants who were reflecting on their own delivery of care (the junior doctors) from those who were primarily discussing other, less experienced doctors' abilities was intended to facilitate uninhibited discussion and enable the group to capitalise on shared experiences to promote a feeling of community.[25] However, it is also of note that focus groups may serve to silence dissenters and those who feel that their own inadequacies contribute to the problems under discussion.[25] The public nature of the discussion may have prevented the deep exploration of individual emotional and behavioural elements, particularly those that contravened group norms.[25,53]

All participants in this study were doctors. Other groups such as nursing staff and patients may offer different perspectives that may enrich the data and further develop the framework. The authors also acknowledge that the juniors' responses suffer from all of the well-documented shortcomings of retrospective self-assessment, particularly when it takes the form of unguided reflection on one's performance.[54,55] Furthermore, the seniors may not have been sufficiently familiar with undergraduate training to adequately contextualise their comments and suggestions. It is hoped, however, that the comparison of junior and senior doctors' responses may, at least in part, offset these group-specific limitations.

As with all forms of interview, the collection and analysis of data are influenced by the social context of the focus group, including the order, structure and language of the questions posed and the inherent power dynamics that are particularly prominent within the hierarchy of clinical medicine.[56] The researcher who facilitated the focus groups (VRT) is a clinician specialising in the care of acutely unwell patients and is therefore embedded within this hierarchy as a senior colleague of some study participants, and a junior colleague or contemporary of others. However, rather than reducing the validity of the data, the use of constructivist grounded theory allows the relationships between researcher and participants to be embraced. The data and theory presented are inseparable from the context in which they were constructed and, to that end, represent not only the participants' views, but also encompass the experiences and ideas of the authors, particularly of VRT.

CONCLUSIONS

The framework presented within this paper prompts consideration of additions or modifications to medical training, which may help to improve the care of acutely unwell patients. Simulation has long been championed as a way of 'bridging the gap'[57] between classroom-based education and clinical practice. A proliferation of recent research has investigated various components of the reliability and validity of educational processes using increasingly sophisticated technology. The opportunity to rehearse acute scenarios without endangering patients, followed by expert debriefing that challenges, adds to and at times deconstructs existing cognitive schemes, is appealing as an educational strategy. However, it has been suggested that simulation which separates clinical decision making from the complexities and pressures of the environment in which those decisions are made may actually hinder educational development.[58] The framework compels us to develop educational strategies that recreate the hierarchical and stressful environment in which junior doctors practise.

This study adds to existing work that emphasises the complex inter-relationships of emotion, affect, decision making and behaviour.[59] It is the responsibility of the medical education community to ensure that newly qualified doctors are aware of the roles played by these factors in errors and adverse events. Emotional skills training, particularly with reference to dynamic, high-stakes situations, should form an integral part of basic medical training. In early postgraduate training, clinical supervisors should help to alleviate the predictable stress of transition by providing junior doctors with explicit expectations of their role, both generally and within an acute care context. Senior doctors should attend to the power of role-modelling and take care to exemplify the behaviours they value in their junior colleagues. Medical training and assessment structures currently emphasise and reward personal knowledge and academic attainment above collaboration and emotional maturity. In the drive to improve patient safety, a key component is the nurturing of doctors who understand human fallibility and feel empowered to ask for help, safe in the knowledge that they will not be deemed to have failed.

Contributors: VRT designed the study, facilitated and transcribed the focus groups, coded all the data, developed

the conceptual framework and drafted the paper. SES assisted in the study design, data analysis, axial coding, development of the framework and drafting of the paper. JS helped to finalise the research question, advised on study design, discussed the coding framework at various stages, assisted in designing the framework and critically revised the manuscript. HSC advised on all stages of the study and was involved in the original design, data analysis checks, conceptual framework development and critical revision of the manuscript. All four authors approved the final manuscript for publication.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article.

Figure S1. A conceptual framework illustrating the major influences, and their inter-relationships, on the behaviour of newly qualified doctors caring for acutely unwell patients.

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Are medical graduates ready to face the challenges of Foundation training?

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ABSTRACT

Purpose of study Previous research demonstrates that graduating medical students often feel unprepared for practice and that their perceptions of preparedness correlate only partially with those of their supervising consultants. This study explores the components of preparedness for practice from the perspectives of both newly qualified doctors and their educational supervisors.

Study design A questionnaire study was undertaken at the University of Edinburgh, involving feedback on preparedness for practice over three consecutive years from 2007 to 2009, against 13 major programme outcomes, from graduates and their educational supervisors. In addition, free text responses were sought and thematically analysed.

Results Graduates consistently felt well prepared in consultation and communication skills but less prepared in acute care and prescribing. Educational supervisors consistently felt that graduates were well prepared in information technology and communication skills but less prepared in acute care and practical procedures. Free text analysis identified four main themes: knowledge; skills; personal attributes; and familiarity with the ward environment.

Conclusions Preparedness for practice data can be enriched by repeated collection over several years, comparison of different perspectives, and incorporation of free text responses. The non-technical skills of decision-making, initiative, prioritisation, and coping with stress are important components of preparing new doctors for practice. Education for Foundation trainees should focus on the areas in which graduates are perceived to be less prepared, such as acute care, prescribing, and procedural skills.

INTRODUCTION

One of the fundamental aims of any primary medical educational programme is to prepare students adequately for clinical practice. In the UK, most medical graduates proceed directly to the 2 year Foundation programme, which consists of 4 month hospital and community based rotations. Foundation year 1 doctors (FY1s) are closely supervised during the day, but also work out-of-hours shifts during which supervision is provided only when requested. Between 1993 and 2009, the General Medical Council has produced several versions of *Tomorrow's Doctors*, a document which provides guidance to medical schools on how best to ensure that their graduates are "properly prepared for clinical practice and the Foundation Programme".[1]

Between 1998 and 2006, all UK medical schools initiated major curricular revisions to align their courses with the recommendations featured in the 1993 version of *Tomorrow's Doctors*.[2] It was hoped that these changes would improve graduates' preparedness for practice. However, recent UK studies continue to demonstrate shortfalls in the perceived preparedness of graduates, with only 59% of 2004 graduates[3] and 58% of 2005 graduates[4] agreeing that their medical school had prepared them for the jobs undertaken when qualified.

Previous studies have demonstrated variable degrees of consistency between the ratings that newly qualified doctors give themselves and those afforded by their educational supervisors (ES). In a West Midlands study, graduates consistently rated themselves significantly higher than did their ES in the vast majority of domains.[5] However, studies in Manchester[6] and Liverpool[7 8] demonstrated a better degree of concordance between the perceptions of newly qualified doctors and their supervisors. A Bristol study that asked new doctors near the end of their first postgraduate year to rate their own levels of competence in a variety of domains found no correlation whatsoever with matched ratings in the same domains provided by their supervising consultants.[9]

While several studies have examined both graduate and educational supervisor perspectives at a single point, none has done so over consecutive years. In addition, few studies undertaken to date have moved beyond the ratings of graduates and ES in predefined domains to ask what additional areas those groups perceive to be important in easing the transition to clinical practice.

STUDY AIMS

The overarching aim of this study was to explore preparedness for practice from the perspectives of both newly qualified doctors and their ES. In order to achieve this, the study aimed to address a series of questions relating to preparedness for practice:

1. How well do medical graduates feel that their primary medical training prepared them for starting work as a doctor in a variety of predefined domains?
2. How well do ES of medical graduates feel that primary medical training prepared those graduates for starting work as a doctor in a variety of predefined domains?
3. How do medical graduates' perceptions of their preparedness for practice in predefined domains compare with those of ES?
4. Which additional areas do graduates and/or ES identify as important in preparation for practice?

METHODS

Setting

This study was undertaken in the context of the MBChB course at the University of Edinburgh,

a 5 year integrated, outcomes based programme with a spiralling curriculum consisting of distinct modules and vertical themes. The 13 overarching programme outcomes define the attributes of a successful graduate and are used to plan learning opportunities and assessment strategies. The course structure was implemented in 1998, and between 2007 and 2009 there were no major curricular changes.

Questionnaire design

A questionnaire study was designed and piloted in 2007. FY1s and ES were asked to rate the preparedness of FY1s in a variety of domains that mapped onto the main Edinburgh MBChB programme outcomes, as shown in box 1. In order to keep the survey relatively short, the questions were intentionally broad and subsequent free text areas allowed elaboration and clarification.

Questions linked to the predefined domains shown in box 1 were used to address aims 1 to 3. Questionnaire responses were scored using a four item Likert scale (poor, satisfactory, good, and very good). In order to address aim 4, two areas for free text answers were provided following the statements:

1. Please provide comments to clarify any of your answers to the above questions.
2. Are there any other specific points you wish to bring to the attention of the medical school in relation to undergraduate medical education in Edinburgh?

Questionnaire distribution

Around half of all Edinburgh graduates remain in South East (SE) Scotland to undertake Foundation training. The questionnaire was sent electronically in February 2008 via the postgraduate institute to all FY1s who had graduated from the University of Edinburgh in 2007 and were working within SE Scotland (53% of the total graduate cohort). Graduates of other medical schools working in SE Scotland were not surveyed. Responses were completed online and returned electronically using a web based questionnaire tool. Final datasets were downloaded anonymously and no attempts to identify individuals were made. On receipt of the questionnaire, graduates would have undertaken almost 6 months of work as an FY1 and thus would have gained reasonable insight into the demands and expectations of the role. The same questionnaire with a different introductory sentence was simultaneously sent to all FY1 ES in SE Scotland who supervised 2007 Edinburgh graduates. General reminders were sent electronically approximately 4 weeks and 8 weeks after distribution of the questionnaire. For the subsequent 2 years, the questionnaire was repeated in identical format to obtain information relating to 2008 and 2009 graduates. Around half (49%) of the 125 ES who were surveyed over the 3 year period only supervised Edinburgh graduates for 1 of the 3 years. Ethical approval for the study was waived by the SE Scotland Research Ethics Service.

Box 1 The 13 questions relating directly to the programme outcomes of the Edinburgh MBChB, shown with the Foundation doctor stem

Please rate your preparedness for practice as a Foundation doctor at the point of graduation from medical school in the following domains (underlying relates to abbreviations used in figure 1):

- Ability to carry out a consultation with a patient (history, examination)
- Ability to provide immediate care of medical emergencies, including first aid and resuscitation
- Ability to assess clinical presentations, order investigations, make differential diagnoses, and negotiate a management plan
- Ability to carry out practical procedures (eg, venepuncture)
- Ability to communicate effectively in a medical context
- Ability to prescribe drugs
- Ability to apply ethical and legal principles in medical practice
- Ability to assess psychological aspects of a patient's illness
- Ability to apply the principles, skills and knowledge of evidence based medicine (EBM)
- Ability to use information and information technology (IT) effectively in a medical context
- Ability to apply scientific principles, method and knowledge to medical practice and research
- Ability to work effectively in a healthcare system and engage with population health issues such as social aspects of a patient's illness and health promotion
- Ability to adopt a self directed and reflective approach to own clinical practice, ongoing learning and professional development.

Data analysis

Questionnaire responses were scored as follows: poor=1, satisfactory=2, good=3, and very good=4. In order to address aims 1 and 2, simple descriptive statistics (mean, standard deviation (SD) and 95% confidence intervals (CIs)) were calculated separately for all FY1 and ES scores in each domain over each of the 3 years. Using combined data from all 3 years, differences between FY1 and ES mean scores in each of the 13 domains were analysed using the unpaired t-test to address aim 3. A value of $p<0.004$ was considered statistically significant for the purposes of this study (5% significance level with Bonferroni correction for 13 comparisons). Statistical analysis was performed using Microsoft Excel 2003.

In order to elicit additional areas considered important in preparing for practice (aim 4), free text responses were analysed thematically. Open coding was undertaken using NVivo8 software which allows development of a cross-group thematic framework while retaining the ability to check contextual validity and source (eg, year) of individual comments. Two researchers independently assigned codes to emerging areas of interest, constantly renaming, redefining, and reorganising the codes to build a thematic grid.[10] Following initial coding, the two researchers discussed differences in the emergent themes until agreement was reached. The data were then recoded by both researchers and the cross-check was repeated, with persisting differences again discussed to agreement.

RESULTS

Total response numbers and rates for each cohort are summarised in table 1. There are a smaller number of ES than FY1s in each year cohort as some consultants provide educational supervision to several Foundation doctors. Overall response totals across the 3 years were 107 FY1s and 85 ES.

Perceived preparedness in predefined domains

For the FY1 and ES datasets, the mean (SD) score for each domain within each year group is shown in table 2. In addition, the table shows the combined means for each domain using the data from all 3 years. For ease of analysis, poorer mean scores are represented by darker shades. The shading highlights the consistency in the scores that were obtained within each group

Table 1 Response numbers and rates

	2007 graduates		2008 graduates		2009 graduates	
	FY1s	ES	FY1s	ES	FY1s	ES
Total number of respondents	52	45	36	16	19	24
Response rate (%)	44%	56%	35%	24%	22%	35%

ES, Educational supervisors; FY1s, Foundation year 1 doctors.

across the 3 years. Table 2 shows that across all 3 years, FY1s felt most prepared in their 'ability to carry out a consultation' and least prepared in their 'ability to prescribe drugs'. ES considered FY1s to be most prepared in relation to their 'ability to use information and information technology' and least prepared in their 'ability to carry out practical procedures'. The Likert scale used in the questionnaire employed a rating of 2 to indicate 'satisfactory' preparation for starting work as a doctor within a particular domain. None of the mean FY1 scores fell below a value of 2 across the 3 years studied, indicating that, on average, they felt at least satisfactorily prepared in all domains. Only one of the mean ES scores fell below a value of 2 (1.86 for 'ability to provide immediate care of medical emergencies' in relation to 2008 graduates), indicating that this is the only domain in which ES would, in general terms, rate graduate preparedness as 'unsatisfactory'.

Comparison of perceptions in predefined domains

Using the combined means from all 3 years shown in table 2, two of the top three domains as scored by the FY1s also fall within the top three domains as scored by their ES (carrying out a consultation and communication). Agreement in domains with poorer scores is less consistent, but three of the five lowest scoring domains using combined FY1 scores also fall within the lowest five domains as scored by ES (prescribing, emergency care, and application of scientific method). However, table 2 also shows some striking disparities between the perceptions of the two groups. Using the combined means, the FY1s placed 'ability to carry out practical procedures' seventh in the table, but the ES rated them far less prepared in that domain, giving the lowest combined mean. To aid comparison of perceptions, figure 1 is a graphical representation of overall means and 95% CIs over 3 years for FY1s and ES. The p-values from the unpaired t-test are displayed above each pair; the differences between nine of the 13 pairs are statistically significant.

Additional areas of importance

Over the 3 years, a total of 156 comments were made in response to the two free text questions, 47 from FY1s and 109 from ES. Seventy-seven of the comments related to the first free text question and 79 to the second, but given the similarity of content, all free text responses were thematically analysed together. Four major themes arose from the comments as described below.

Theme 1: Knowledge

Despite a specific question enquiring about preparedness to 'prescribe drugs', there was discontent expressed by both FY1s and ES in relation to pharmacology knowledge and practical prescribing ability.

Table 2 Mean (SD) in each domain for each year group

	FY1 responses				ES responses			
	2007	2008	2009	Overall	2007	2008	2009	Overall
Consultation	3.35 (0.68)	3.42 (0.55)	3.11 (0.65)	**3.33** (0.64)	2.69 (0.79)	2.69 (0.79)	2.57 (0.89)	**2.65** (0.81)
Communication	3.13 (0.77)	3.53 (0.56)	3.00 (0.74)	**3.24** (0.72)	2.71 (0.66)	2.81 (0.75)	2.58 (0.65)	**2.69** (0.67)
Psychological aspects	3.08 (0.66)	3.19 (0.62)	3.16 (0.83)	**3.13** (0.75)	2.43 (0.73)	2.50 (0.73)	2.41 (0.85)	**2.44** (0.84)
Social aspects	3.12 (0.68)	3.11 (0.75)	3.05 (0.69)	**3.10** (0.70)	2.42 (0.70)	2.44 (0.51)	2.61 (0.89)	**2.48** (0.72)
Self directed	3.02 (0.64)	3.31 (0.62)	2.89 (0.66)	**3.09** (0.65)	2.32 (0.83)	2.31 (0.87)	2.58 (0.92)	**2.39** (0.86)
IT	2.92 (0.76)	3.19 (0.58)	2.68 (0.75)	**2.97** (0.72)	2.98 (0.74)	3.06 (0.57)	2.88 (0.74)	**2.96** (0.70)
Practical procedures	2.75 (0.82)	3.14 (0.76)	3.11 (0.74)	**2.94** (0.80)	2.09 (0.78)	2.00 (0.68)	2.10 (0.88)	**2.08** (0.78)
Assess clinical presentations	2.77 (0.70)	2.94 (0.68)	2.74 (0.56)	**2.82** (0.67)	2.20 (0.78)	2.13 (0.96)	2.30 (0.82)	**2.21** (0.82)
Ethical and legal	2.82 (0.74)	2.78 (0.68)	2.84 (0.76)	**2.81** (0.72)	2.48 (0.71)	2.86 (0.77)	2.65 (0.83)	**2.59** (0.77)
Scientific methods	2.65 (0.74)	2.94 (0.79)	2.42 (0.61)	**2.71** (0.75)	2.19 (0.77)	2.25 (0.77)	2.17 (0.65)	**2.20** (0.73)
EBM	2.55 (0.73)	2.66 (0.64)	2.32 (0.75)	**2.54** (0.70)	2.26 (0.69)	2.40 (0.74)	2.26 (0.69)	**2.28** (0.69)
Emergency care	2.52 (0.70)	2.58 (0.87)	2.37 (0.76)	**2.51** (0.77)	2.20 (0.68)	1.86 (0.53)	2.05 (0.72)	**2.09** (0.67)
Prescribing	2.33 (0.79)	2.69 (0.86)	2.37 (0.76)	**2.46** (0.81)	2.09 (0.79)	2.13 (1.15)	2.22 (0.90)	**2.13** (0.89)

EBM, evidence based medicine; ES, Educational supervisors; FY1s, Foundation year 1 doctors; IT, information technology.

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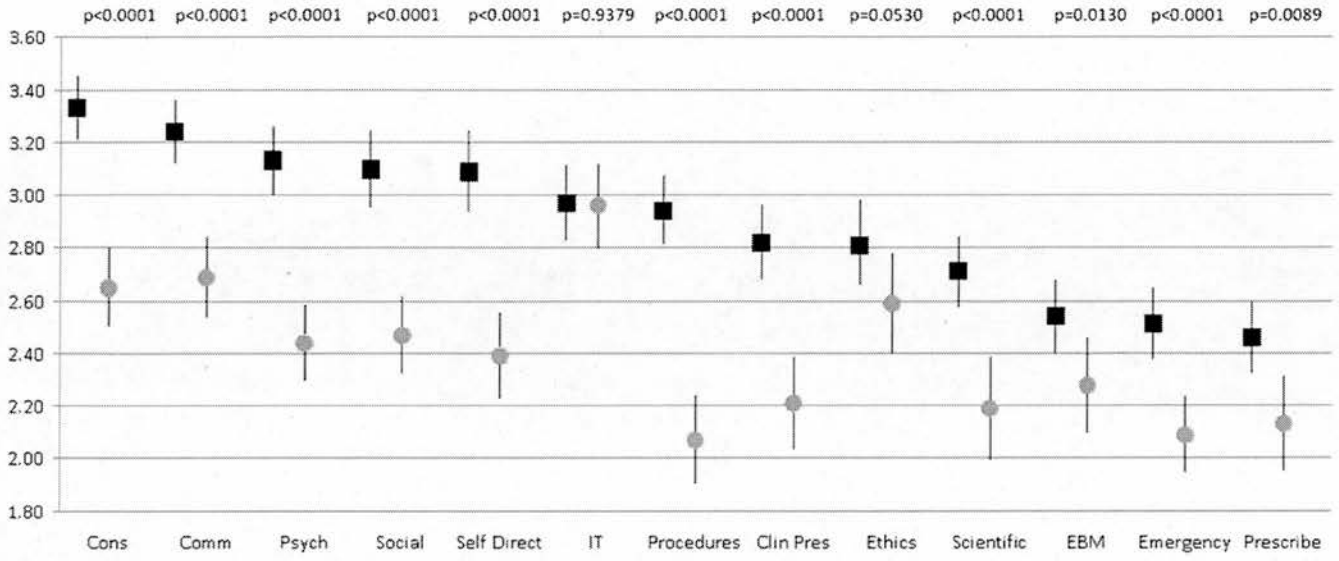

Figure 1 Overall means and 95% CIs over 3 years for Foundation year 1 doctors (FY1s) (black squares) and educational supervisors (grey circles) in the various domains. Clin pres, clinical presentations; Comm, communication; Cons, consultation; EBM, evidence based medicine; IT, information technology; Psych, psychological aspects.

> FY1 (2008): "I feel that my knowledge of pharmacology was poor compared to other aspects of medicine..."

> ES (2007): "I would regard most FY1s as frankly reckless in their prescribing..."

Anatomy and physiology were other areas in which respondents felt that FY1s lacked knowledge, particularly in comparison with their predecessors. Additionally, FY1s were felt to have difficulties translating knowledge into practice.

> ES (2008): "Theoretical knowledge of anatomy, pathology and clinical subjects is not as strong as it used to be and this now hinders teaching in clinical years."

> ES (2008): "Good theoretical knowledge, but inexperienced at putting this into practice."

Theme 2: Skills

Technical skills

Identification and management of acutely unwell patients appeared to be a source of concern for both ES and FY1s.

> FY1 (2009): "The one set of scenarios in which we do need to act as such is very acute emergencies—an area in which we received far too little training given the responsibilities in this respect which circumstances often place on us."

> ES (2009): "They are not always good at recognising an acutely unwell patient or identifying those that need to be prioritised."

Non-technical skills

Respondents placed great emphasis on non-technical skills including decision making, initiative and prioritisation.

> FY1 (2008): "I felt under-prepared for making clinical decisions..."

> ES (2007): "Very few of the FY1 doctors will take any initiative..."

> FY1 (2009): "We received absolutely no training in most of the critical day-to-day-relevant aspects of being an FY1: prioritising, managing and keeping track of a large workload of tasks and jobs, many of which will be completely unfamiliar..."

Interpersonal non-technical skills received more favourable comments from both groups. While the FY1s were generally felt by their supervisors to be effective and sensitive communicators with patients, inter-professional communication, including referrals and ward-round presentations of patients, received more critical comments.

> ES (2008): "Although good communicators with patients, they are generally sub-optimal in their communication with other medical staff..."

A series of comments suggested that supervisors are concerned by the level of stress experienced by newly qualified doctors and that the FY1s were not optimally equipped with strategies to cope with stress.

> ES (2008): "I have been concerned about the amount of sick leave FY1s take usually related to stress."

> FY1 (2007): "I'm sure it must be normal for graduates to feel out of their depth when starting work, but in retrospect many parts of the curriculum seem poorly designed to help us meet this challenge as well as we might."

Theme 3: Personal attributes

There were many comments relating to personal attributes of Edinburgh graduates. Problems relating to lack of confidence were mentioned by both ES and FY1s.

> ES (2007): "They have a great deal of knowledge but little confidence..."

> FY1 (2008): "I ... was lacking confidence in putting pen to paper as we went from no responsibility to high levels of responsibility overnight."

Other largely complimentary comments from ES related to enthusiasm, reliability, and other aspects of professionalism.

> ES (2009): "Most FY1s are bright, keen and hard-working and a pleasure to work with."

Theme 4: Familiarity with ward environment

Both FY1s and ES felt that familiarity with the environment of the wards was an important component of transition from

medical student to FY1. Comments from FY1s suggested that spending longer on the wards would result in increased familiarity with the day-to-day jobs involved in 'running a ward', incorporating both clinical and administrative duties.

> FY1 (2007): "The only aspect of preparation for practice that I felt I lacked when starting was the practical experience of running a ward."

> FY1 (2008): "Undergraduates should have more exposure to everyday ward work and tasks, to better prepare them for FY1."

DISCUSSION

FY1s graduating from Edinburgh medical school between 2007 and 2009 felt that their preparation for Foundation training was good in five out of the 13 MBChB programme outcomes, and satisfactory in the remaining eight. Over the same period, FY1 ES felt that the preparation for Foundation training had been satisfactory in all 13 domains. The perceptions of graduates and their ES were significantly different in the majority of domains. However, the additional aspects of preparing for practice that were identified by the two cohorts showed remarkable similarity.

In concordance with other studies, FY1s in this study consistently scored themselves significantly higher than did their ES in the majority of domains.[5 6] It is possible that some of this difference may be due to ES bias against the domains themselves, perhaps viewing some of them as irrelevant to everyday clinical practice. The greatest disparity in the perceptions of the two groups related to 'ability to carry out practical procedures', echoing the results of a previous study.[5] A South African study that correlated newly qualified doctors' self-assessment scores in practical procedures with OSCE (objective structured clinical examinations) scores also demonstrated misplaced confidence.[11] The 'ability to provide immediate care of medical emergencies' was the only domain in which preparation of any graduate cohort was deemed, on average, to be unsatisfactory. Concerns relating to the care of acutely unwell patients were also evident in the qualitative data. Such findings concord with other studies and lack of preparedness in this domain appears to be a perennial problem, both within the UK and throughout the world.[5 12–15]

Analysis of the free text responses highlighted a number of areas that had not featured in the questionnaire, yet were felt by respondents to be important components of preparedness for practice. While the questionnaire specifically asked respondents to score 'ability to communicate effectively in a medical context', it did not differentiate between communication with patients and colleagues. These two types of communication present subtly different challenges for newly qualified doctors, and preparedness for each is important. The free text comments indicated that some FY1s and their ES felt that they had been well prepared to communicate with patients and relatives, but less prepared in relation to communication with colleagues. It is of interest that most other studies in this area do not differentiate between communication contexts.[6 8 16] The single study that does make this differentiation concords with our findings: consultants and specialist registrars felt that FY1s were better prepared for communicating with patients and relatives than with medical colleagues.[17]

Opinions regarding non-technical skills such as decision-making, initiative and prioritisation were not specifically sought within the questionnaire, but were attributed importance by both FY1s and their ES. Task prioritisation has previously been identified as an important component of the FY1 role which is usually learnt 'on the job', making doctors in their early days feel unprepared.[13 18] The first postgraduate year is renowned for being a stressful and difficult year.[19] At least some of the stress experienced by newly qualified doctors seems to relate to exposure to specific events such as acutely unwell patients, on-calls or night shifts.[13] It may also relate to commencing a new placement with insufficient induction processes and uncertainty of role.[20] Suggestions to improve preparedness for practice made by respondents to our questionnaire included encouraging students to spend longer on the wards to increase familiarity with day-to-day jobs and increased shadowing time. These suggestions echo the findings of a large study commissioned by the General Medical Council[13] that informed the 2009 version of *Tomorrow's Doctors*[1] recommendation of a Student Assistantship period (in which students take on the role of Foundation doctor) as an integrated part of primary medical training. It will be interesting to track preparedness for practice in future years, both in our institution and UK wide, as these new standards are implemented.

Limitations

This study combines the strengths of three consecutive years' data with two different perspectives. It is, however, limited by its poor response rate and narrow setting within Edinburgh medical school. Furthermore, only Edinburgh graduates who took up FY1 posts within SE Scotland were surveyed. It is possible that those who responded to the survey either had particularly strong feelings on the preparedness of Edinburgh graduates to begin clinical practice or, in the case of FY1s, felt prepared enough to devote time and energy to an optional questionnaire. The responses may therefore not be representative of the whole cohort, and consideration needs to be given to incentives and other methods of improving response rates in future years. New national application procedures for Foundation training have resulted in a gradual decrease in the number of Edinburgh graduates remaining in SE Scotland. It is therefore essential that the medical school finds ways of maintaining contact with graduates who have moved further afield and even outwith the UK. The use of a questionnaire as a data collection method limited the study in terms of discovering *why* respondents hold the views that they do, a question best answered using interview based techniques. In addition, the study sought information on perceived preparedness as opposed to actual preparedness, two variables which cannot be assumed to correlate. A recent Japanese study, for example, found no correlation between pass rate on the National Medical Licensure Examination and perceived preparedness for practice in any domain.[21]

Further research

When considered in the context of previous research, this study has identified several areas requiring further work. The suggestion that FY1s are better prepared to communicate with patients and relatives than with colleagues has received little attention in the literature and warrants further exploration. A more detailed understanding of the specific challenges faced by newly qualified doctors when managing an acutely unwell patient is required, so that this perennial problem may be tackled. In addition, improving the abilities of newly qualified doctors to self-assess their competence, particularly in relation to procedural skills, is crucial to ensuring the safety of patients.

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Main messages

- Preparedness for practice data may be enriched by repeated collection over several years and incorporation of free text responses.
- The non-technical skills of decision-making, initiative, prioritisation, and coping with stress may be important components of preparing new graduates for practice.
- Curriculum development, in particular the UK Student Assistantship, should emphasise the specific challenges of acute care and prescribing.
- Education for Foundation trainees could focus on the areas in which graduates are perceived to be least prepared, such as acute care, prescribing, and procedural skills.

Current research questions

- Why do newly qualified doctors feel better prepared for communication with patients than colleagues?
- What are the specific challenges faced by newly qualified doctors when caring for acutely unwell patients?
- How can the abilities of medical students and new graduates to self-assess their competence in procedural skills be improved?

CONCLUSION

In evaluating preparedness for practice, valuable insights may be gained by looking beyond core curricular competencies to include other skills that are required by newly qualified doctors such as decision-making, initiative, prioritisation, and coping with stress. In addition, medical schools may glean more valuable information by differentiating between patients and colleagues in questions asking about communication skills. Education for Foundation trainees could focus on the areas in which newly qualified doctors are perceived to be less prepared, such as managing acutely unwell patients, prescribing, and procedural skills.

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